TECHNOLOGY

SEPTEMBER 1960

approach

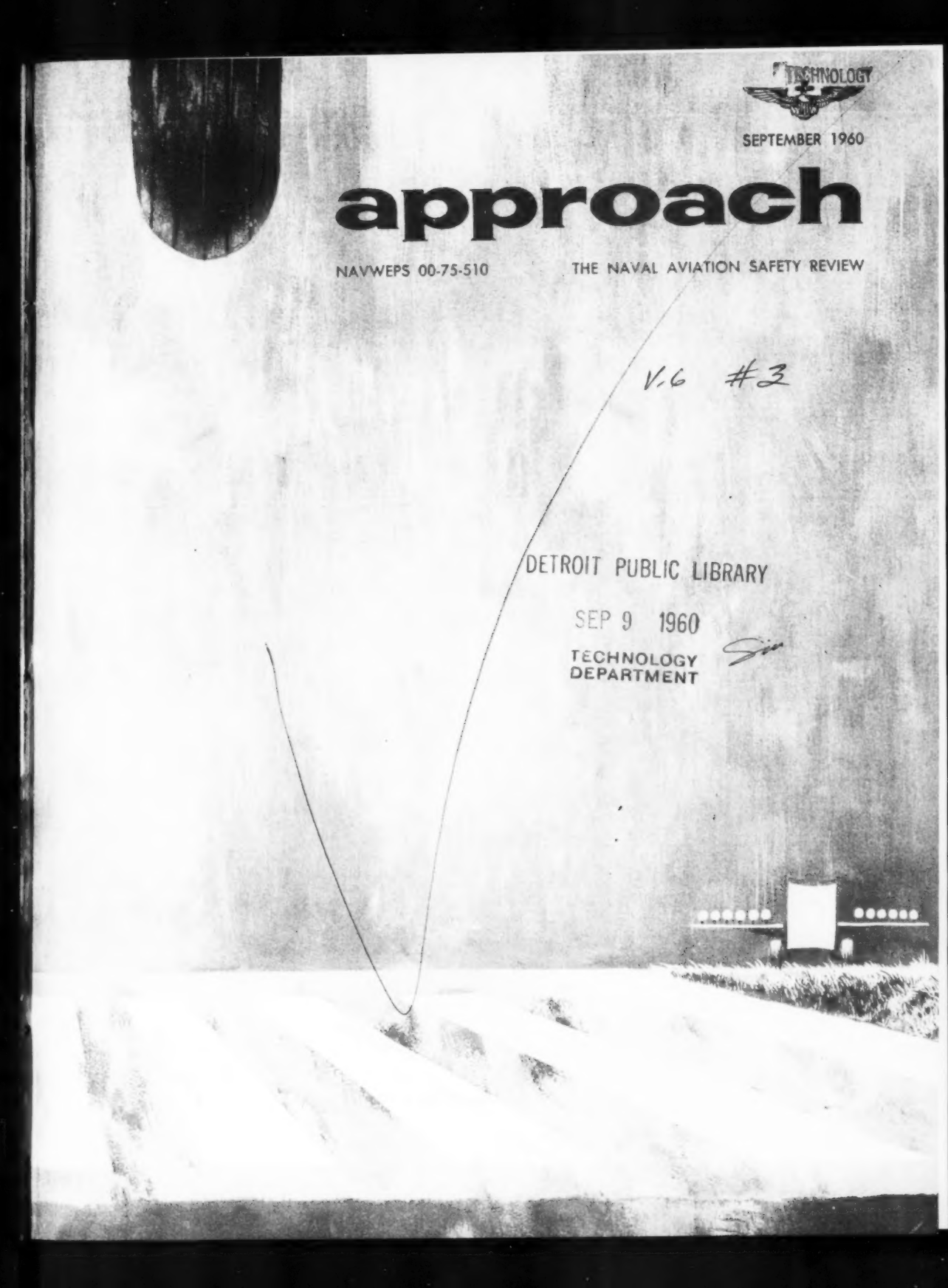
NAVWEPS 00-75-510 THE NAVAL AVIATION SAFETY REVIEW

V.6 #3

DETROIT PUBLIC LIBRARY

SEP 9 1960

TECHNOLOGY
DEPARTMENT



Just before pull up

Pull up before ejection

Pilot and chute seen on left

Pilot and chute on left, seat or canopy on right

Zoom Pays Off

While the Martin-Baker and other low level capability ejection seats are being retrofitted to most first line jet aircraft as soon as possible, it is heartening to view this sequence of photos showing the successful, almost miraculous employment of the current seat. During the catapult run the shuttle ramp struck the F4D, which shortly thereafter burst into flames. At an altitude estimated at approximately 250 feet, but possibly more because the aircraft was in a noseup attitude with some rate of climb remaining, the Air Force exchange pilot ejected. The standard Navy seat with optional "zero delay lanyard" performed well, and the pilot splashed well clear of the wreckage. He was picked up by helicopter and returned to the carrier within minutes, and with minor injuries.

IN THIS ISSUE

'And Then There Was One'	4
Pilot Controller Relationship	11
Monitor	12
Common Senses	14
APH-5 Helmet	17
Fire Protection	18
More Light on the Black Hole Problem	20
Whiz Quiz	23
Visual Glide Path Indicators	24
'Set Condition One'	27
Finally It Happened to Me	30
Headmouse	34
Servicing the F4H	36
Backfiring	39
Slipping Jacks	41
Inspection Aims	46
Murphy's Law	47

Vol. 6 APPROACH No. 3

The Naval Aviation Safety Review

Published by U. S. Naval Aviation Safety Center NAS, Norfolk 11, Va. RADM William O. Burch, Jr. Commander

Head, Literature Dep't. CDR J. M. Wondergem
Editor, A. B. Young, Jr.
Managing Editor, LCDR D. M. Hume
Associate Editors
Flight Operations, LCDR A.K. Clark, J. T. LeBarron, JOC
Maintenance, J. C. Kiriluk
Av. Med., Survival, Julia Bristow
Distribution, LT W. B. Kennedy
Art Director, Robert B. Trotter
Illustrator, T. W. Healy, ALC
Photographer, J. E. Williams, PHC

Purpose and Policies: APPROACH is published monthly by the U.S. Naval Aviation Safety Center and is distributed to naval aeronautical organizations on the basis of 1 copy per 12 persons. It presents the most accurate information currently available on the subject of aviation accident prevention. Contents should not be construed as regulations, orders, or directives. Material extracted from Aircraft Accident Reports (OpNavs 3750-1 and 3750-10), Medical Officer's Reports (OpNav 3750-8) and Anymouse (anonymous) Reports may not be construed as incriminating under Art. 31, UCMJ. Photos: Official Navy or as credited.

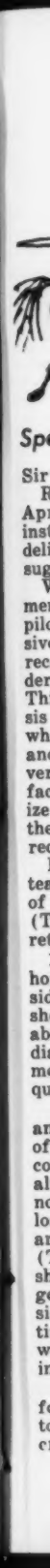
Non-naval activities are requested to contact NASC prior to reprinting APPROACH material.

Correspondence: Contributions are welcome as are comments and criticisms. Views expressed in guest-written articles are not necessarily those of NASC. Requests for distribution changes should be directed to NASC, NAS Norfolk 11, Va., Att: Literature Dep't.

Printing: Printing of this publication approved by the Director of the Bureau of the Budget, 31 Dec 1957.

Subscriptions: Single copy 30 cents; 1-year subscription $3.25; 75 cents additional for foreign mailing. Superintendent of Documents, U. S. Government Printing Office Washington 25, D. C.

Library of Congress Catalog No. 57-60020.



LETTERS

Special Deliveries

Sir:

Re the excellent articles in the April 1960 APPROACH dealing with instrument recoveries from "special deliveries," I have the following suggestion:

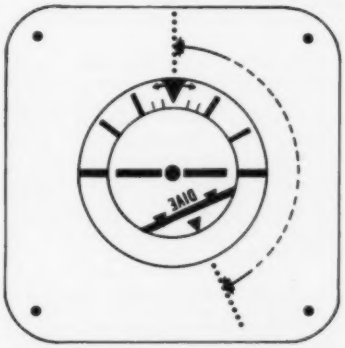
While working as a jet instrument examiner, I discovered that pilots, occasionally, were apprehensive with respect to their ability to recover from unusual attitudes under actual instrument conditions. This was partly due to overemphasis of the use of the turn needle—which is hard to read in turbulence and doesn't tell you when you're inverted—and partly caused by the fact that the pilots tried to visualize the attitude of the aircraft on the gyro horizon before initiating recovery.

I simplified their problem by teaching them, often in a matter of minutes, the following technique (T-Bird; J-8 attitude indicator), to return to normal flight:

1. Level the wings on the gyro horizon by moving the fixed (outside) reference point along the shortest distance toward the movable (inside) reference point (see diagram). The direction of stick movement coincides with the required movement of the fixed point.

2. Adjust the pitch attitude by any of the established methods (use of throttle speed brakes, etc., in combination with the gyro horizon, altimeter, ASI, VSI). It should be noted here that the gyro horizon loses much of its enigmatic appearance after the wings are leveled. (The reading of the instrument should be disregarded while it is going through a controlled precession—vertically up or down. Continued back-pressure on the stick will restrict this time to a minimum.)

This method eliminates the need for thinking and is ideally adapted to the high rate of roll of jet aircraft. After a pilot is familiar with the system, it should not take him more than two seconds to level the wings from any unusual attitude. If the manufacturer would mark the instrument with two arrows, as indicated in the diagram, even the need to remember that the outside reference point moves with the stick could be eliminated. This, incidentally, would also reduce the chance of applying aileron pressure in the wrong direction after a prolonged turn.



Pilot's view of the gyro horizon. To level wings; move the outside reference point, with the stick, along the shortest distance towards the inside reference point as indicated by dashed line.

It is assumed here that the gyro horizon is within its normal working limits. An instrument with a bank error of as much as 30 degrees has no place in a high performance aircraft. It is the pilot's responsibility to keep his instruments up to par by making a meticulous write-up whenever he notices a deviation beyond the official limitations of an instrument.

I do not want to create the impression of underestimating the value of the turn needle. I want to state that I consider it one of the most reliable blind flying instruments and that every pilot should be completely familiar with its use. However, I see no reason why we should not fully utilize the excellent qualities of the versatile gyro horizon when we need them most. It is not a precision instrument, but it certainly expedites return to a normal aircraft attitude after violent maneuvers.

GERARD M. BRUGGINK

Tempe, Ariz.

APPROACH welcomes letters from its readers. All letters should be signed though names will be withheld on request. Address: APPROACH Editor, U. S. Naval Aviation Safety Center, NAS Norfolk, Va. Views expressed are those of the writers and do not imply endorsement by the U.S. Naval Aviation Safety Center.

Recorded Time

Sir:

I received a suggestion from an air controller recently concerning taped information. There are several types of tape recorders used in Control Towers but all, and I mean all of them are susceptible to errors in time such that it is difficult in most circumstances to fix the chronology of events with great accuracy when radioed information relating to an accident is recorded.

The Air Controller, Harvy P. Reynolds, AC 1, suggested that it become SOP for the talker in the tower to transmit "This is _____ tower on the guard; time is_____.", at some time shortly after learning of an aircraft accident or incident. In that manner the time is recorded on the tape and it is a simple matter to play back the tape and count the time. (Time is marked in one minute intervals on most tapes).

R. E. POST, JR., LT
Aviation Safety Officer, VT-5
NAS Saufley Field

● Why not?

Continued

Something for the Pot

Sir:

After watching airplanes operate in many places at all times of the day and night and under every conceivable weather condition I have become convinced that our carrier types aren't getting a fair shake when asked to come aboard the boat in instrument meteorological conditions.

Ashore, GCA has been bringing our birds in safely for more than 15 years with 360-degree surveillance radar and precision course and glide slope control. Not so CCA which has no picture of the waveoff pattern and no height determination other than the pilot's altimeter.

In this age of electronic miracles it seems inexcusable that our carriers cannot be fitted with radars which can control approaches as precisely as GCA. I am well aware of stabilization needs but the old "gun club" licked this problem with 16-inch guns many years ago.

To make our problem even simpler, it isn't necessary to stabilize the glide slope antenna since the necessary correcting data can be applied right in the indicator group. Having thus eliminated inertia, stabilization is simplified. Don't forget "Atlas" was gyro guided 5000 miles to a 20-mile miss on 22 June so don't mention platform reference.

I hope someone in the right position in Washington will agree with *my* thoughts and stir the pot just a little bit.

CDR MOUSE

Starting Points

Sir:

Thank you for the outstanding coverage of "R3350 Engine Fuel Discrepancy," in the February APPROACH. We agree with all your recommendations except the one concerning "the collected fuel burnout" in an involuntary start, since this involves the fuel/air ratio passing through the lean range.

VA-15's SOP calls for commencing steady prime at the same time the magneto switch is turned ON. By using this procedure we have had excellent success with warm engine starts, and recommend the same procedure for *all* starts. At worst, this could only cause occasional flooding and we consider this the lesser of two evils (i.e. lean with possible backfire versus rich with possible flooding) particularly since flooded engine starts are covered nicely in the Flight Manual. In all cases a proper shutdown will help both by providing adequate cooling, and as you pointed out, by reducing the amount of fuel in the supercharger housing.

We were surprised that you did not comment about pilots advancing the mixture control to RICH on a surge. The engine should be running SMOOTHLY ON PRIMER ALONE before the mixture is advanced.

The mention of eight-bladed starts struck us like the sound of chalk screeching on a blackboard. We realize that it was done in the interest of experimentation but we hope no impressionable junior birdmen take their cue from those starts.

R. A. MASSEY, JR., LT
Maintenance Officer

VA-15

Sighted Survivor

Sir:

My letter in the March issue, your comments concerning that letter, and CDR Tate's in the June issue probably all gave the jet problem and keeping a survivor in sight too fast a brush.

First, regarding keeping a survivor *in the water* in sight, we're not going to do it unless we're at 200-500 feet in a tight turn with eyes glued to the spot. I know there can be exceptions in unusual conditions but the photographs I am enclosing of the pick-up of an F11F pilot who ejected give an indication of the problem. The helicopter is either approaching the man or hovering over him during the photos. There is a lack of color contrast and the natural tendency of camera lenses to decrease the size of objects, but unless you know there is a man in the picture, you wouldn't give the areas a second look. The existence of white caps, small size of a man or pararaft and great expanse of water without reference points make the problem difficult even at very low altitude.

Most jets will be unable to descend to an altitude low enough to sight a man in the water, let alone keep him in sight, then climb to an altitude and return to base, due to their own fuel situation. Obviously, a man in the water can't be expected to pick up a signal from them that he is or isn't in sight. The jet in the air who sees a pilot eject can probably do nothing other than turn his IFF to emergency and report the situation to the nearest SAR base and give a Tacan bearing and distance. He should orbit *at altitude* in the immediate vicinity as long as possible while he has the chute in sight to assist in getting his position plotted accurately by radar.

If you can get low enough to see a man, you need to slow the plane to a better search speed and to circle in a smaller area near the man with drag (gear down) but you must add lift or your power requirements make this one quick look and home. Judicious use of flaps can help here. Gear is not the preferred drag system, but the man needs a signal if you have him in sight so he can save his distress signal, and speed brakes could not be seen by the man in the water. Keeping the man in sight helps you to maintain an *exact* position from which to vector a chopper or other SAR equipment expeditiously. Then since he has been able to save his signaling equipment, knowing you had him visually, he will use it to bring the copter to his position.

We still maintain here that gear down at this point is the only workable system for aircraft without droppable equipment to indicate that you have the man in sight. Changing direction of orbit, we are taught in early basic training, is the easiest way to lose sight of any object. Also if you orbit to right in types such as the F3D and A3D, you then must depend on a non-pilot observer to find your man and then switch over to a left orbit and find him yourself. Direction of orbit might be usable if you must remain at high altitude as a signal that you saw his chute open. If you didn't, however, you would be trying to find it in a right turn again and possibly using non-pilots as primary lookouts. Besides, at this point, the man would not be using signals, so all you would accomplish is improving his morale. When the man is in the water he may have spray and water in his face too much to analyze your route of flight or he could become too seasick to analyze or even to care. Also if you just cycle gear, he could be submerged or faced the wrong way during the time you cycle.

The gear should remain down as long as you are able to stay over the man. The reverse, as now practiced by VMT-1, would mean you conduct a search for a man you have lost sight of with gear down,

and go to a normal condition when you sight him or give up the search and he has to figure out which.

The objections of CDR Tate and the editor were expressed by others at the all-unit safety officers' meeting, and subject to limitations of individual models, which each unit must consider, this general system was evolved.

O. W. SILER, CDR, USCG
CO, CG, Air Det.
NAS Corpus Christi

● **CDR Siler's pictures have not been produced here because he is absolutely right—you can't see a thing.**

Human Factor

Sir:

I wonder why the article, "I've Got It!" in the June issue of APPROACH appeared on the "Notes From Your Flight Surgeon" page. The story is about 2 pilots making a landing in the SNB, having a disagreement about who was controlling the aircraft during landing rollout that resulted in an accident. Impact forces were negligible and there were no injuries.

The Flight Surgeon on the case had the following to say:

> "This raises two extremely important questions. They are: 1) How far on a first pilot check should a check pilot allow his student to go before he insists on taking over control? and 2) How strongly must it be emphasized that when the instructor or senior pilot says 'I have it' that is just exactly what he means?"

I wonder what the Training Officer contributed to this accident investigation.

T. K. DOLES, LCDR
US Naval Research Lab.
Washington, D. C.

● **"I've Got It" appeared in the Notes from Your Flight Surgeon section because this was a human factor type accident. To quote the AAR: "From the investigation it is apparent that (the pilot) was so intent in satisfactorily passing the first pilot check that he did not want to give up control of the aircraft and he allowed his better judgment to be overshadowed by his eagerness and ability." A basic lack of clarification of military authority as to who was in control of the aircraft (as covered by OpNav Inst 3710.7A) led to a situation of "nobody lets go of the stick."**

The training officer's *direct* contribution to this accident investigation cannot be determined from the accident report.

Incidentally, a discussion of an accident along the same lines appeared under the title of "Who's In Control?" in the *Weekly Summary*, 28 Sept-4 Oct 1959. This instance of confusion over who was in control of the aircraft led to the death of the crewman, injury to the pilots and loss of an aircraft.

PHOTO & ART CREDIT:

Photo Page 27, courtesy of Miss M. M. Carson, Canadian Owners and Pilot's Association.

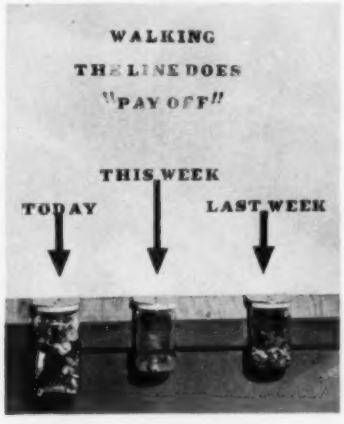
Photo page 36, courtesy of McDonnell Aircraft Corp.

Art page 37, detail from painting by Joseph Hirsch, courtesy of Abbott Laboratories Collection.

Walking the Line

Sir:

Here's a photograph of a FOD reminder displayed in the NARTU hangar here at NAS Memphis. As a jet engine field rep for Wright Aero the writer is very conscious of the many number of engines removed prematurely for foreign object damage and am therefore passing on this idea of alerting all personnel as to the need of policing parking and taxi ramps even though the latest type sweepers are available. I feel that the display shows what can accumulate over a week end.



The "TODAY" jar shows what was picked up on Monday or the first day of the week. The "THIS WEEK" jar had just been emptied from the previous week's accumulation.

This display has helped to prove many factors such as: Removed lockwire not being properly disposed of. Loose gravel on hangar roofing being blown onto ramp. Nuts and bolts as well as washers are being "lost" while servicing aircraft on the line. Any of these items could cause a FOD premature removal.

A. VAN DEN BROECK
NARTU Memphis Wright Aero Rep

Guidelines and Bouquets

Sir:

The format and layout of your magazine is outstanding. Many otherwise dry and too complicated a subject matter is presented in a most interesting manner. In fact, we have found APPROACH to be a useful tool to us in maintenance since we started removing articles that pertain to maintenance problems and posting them on the crews' bulletin boards in the various shops so that all our people can read the articles that pertain to their specific jobs.

For example, your recent articles on FURs, "Smoke Signals You Should Know," "Yellow Sheet Discrepancies" and "Murphy" are must reading by all hands. We are pleased to note that people read them on their own volition—they are interesting, concise and educational.

Keep 'em coming!

L. L. DOBBS, LCDR, USN
Maintenance Officer,
VP-45, FPO, N. Y.

● **Those are not only kind words sir, but the kind of guidelines we need to build the magazine the way you'd like to have it built.**

"And then there was one!"

by
CDR John J. Gallagher

THIS is the story of the continuing struggle to bring about a common system of approach and landing lights to best serve our aviation needs. The system applies in the main to land bases having all-weather operational capabilities. Certain exceptions will always exist as for carriers, advanced bases . . . but certain elements of a common system can and should be utilized even for these exceptional environments. The aim of every pilot is to bring his plane down safely, and he should have systems of guidance proved to be best from the standpoint of human control.

In the dim past, ANC standards assured for the most part a common system of airfield lighting, however, with the appearance of many different aircraft types for military purposes, an increasing number of aviation lighting experts, and real or imaginary differences in operational requirements, the ANC standards (now known as U. S. National Standards) could not be developed rapidly enough to maintain the standardization previously enjoyed.

The prime area of divergence has been in approach lighting, however, similar difficulties are now appearing in the "runway touchdown-zone lighting" developments. To explain this remark it may be well to review the evolution of approach lighting, treating civil, Navy and Air Force developments individually.

Civil systems began in the late 30's with the low intensity red neon system, having neon bars spaced 100 feet apart extending 1500 feet into the approach zone approximately in line with the left hand row of runway lights as in Fig. 1. Although this system is no longer supported by the FAA, some were continued in service and still may be observed at certain locations.

The recognized need for an optimum approach lighting system brought about a development and evaluation program jointly sponsored by civil and military interests over a period of several years at LAES (Landing Aids Experimental Station), Arcata, California, beginning in 1946.

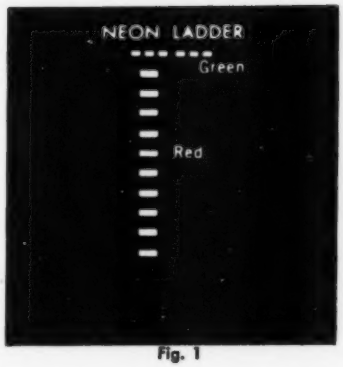
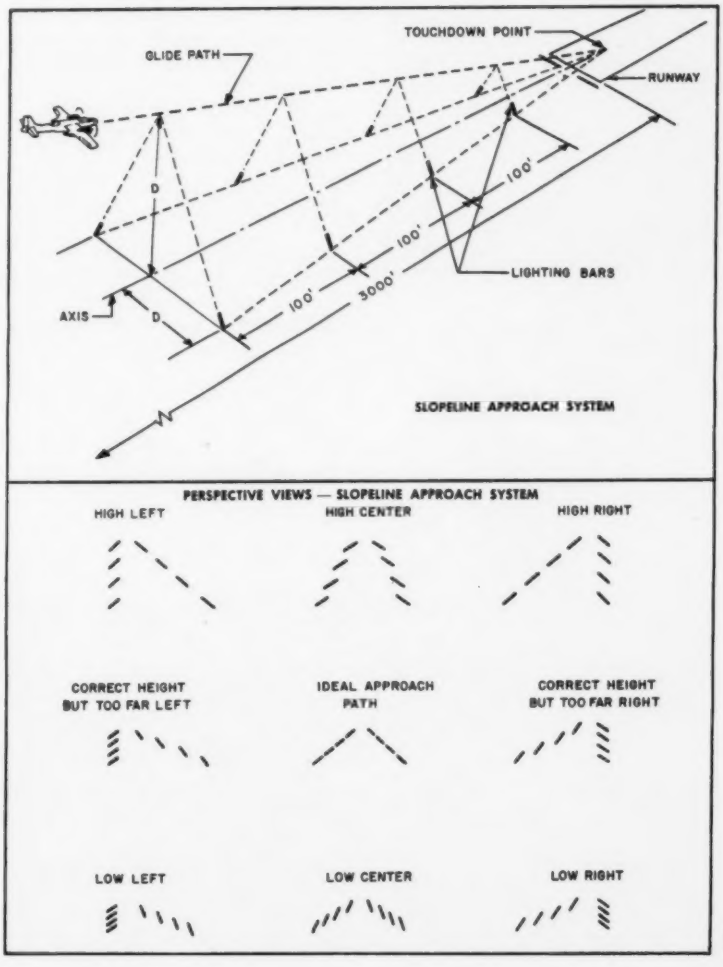


Fig. 1

In 1949 the governing joint civil-military committee decided upon the High Intensity "Slope Line System," Fig. 2, as the new standard. This system had the same threshold bar as Left Hand row. The CAA (now FAA) in-

Fig. 2



stalled four such systems shortly thereafter at Indianapolis, Washington, D. C., Idlewild and Los Angeles. Strong objections to the system by the Airline Pilots Association coupled with insurmountable terrain problems, caused the CAA to withdraw support from the Slope Line configuration in 1950.

A compromise system labeled "Left Hand Row High Intensity System," Fig. 3, then emerged as an interim civil standard pending further study and evaluation. This configuration consisted of parallel 5-light bars, spaced 100 feet apart on center, extending 3000 feet along the left side of the approach zone, and designed for five steps of intensity control. All neon systems serving instrument runways at major civil airports were subsequently converted to the "Left Hand Row System."

Fig. 3

Meanwhile, operational evaluation studies of a "centerline system" advocated by ALPA were conducted on a system of this type installed at Newark, New Jersey. The outcome was the adoption of Configuration "A", Fig. 4, as the Civil Standard early in 1953 (System interpretation is shown in Fig. 4a.). The Navy and the Air Force dissented for a variety of reasons. Later that year it became one of three configurations contained in the official U. S. National Standard on Approach Lighting. "B" configuration was the Air Force

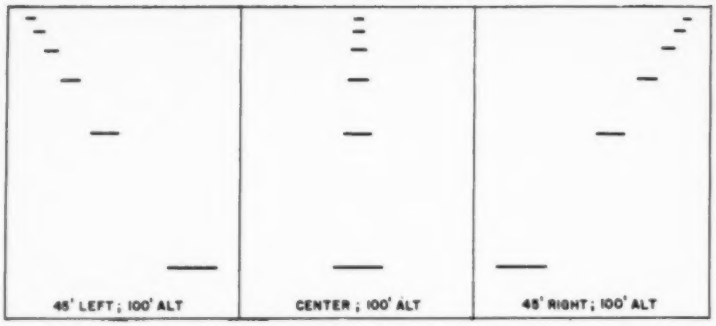


Fig. 4A

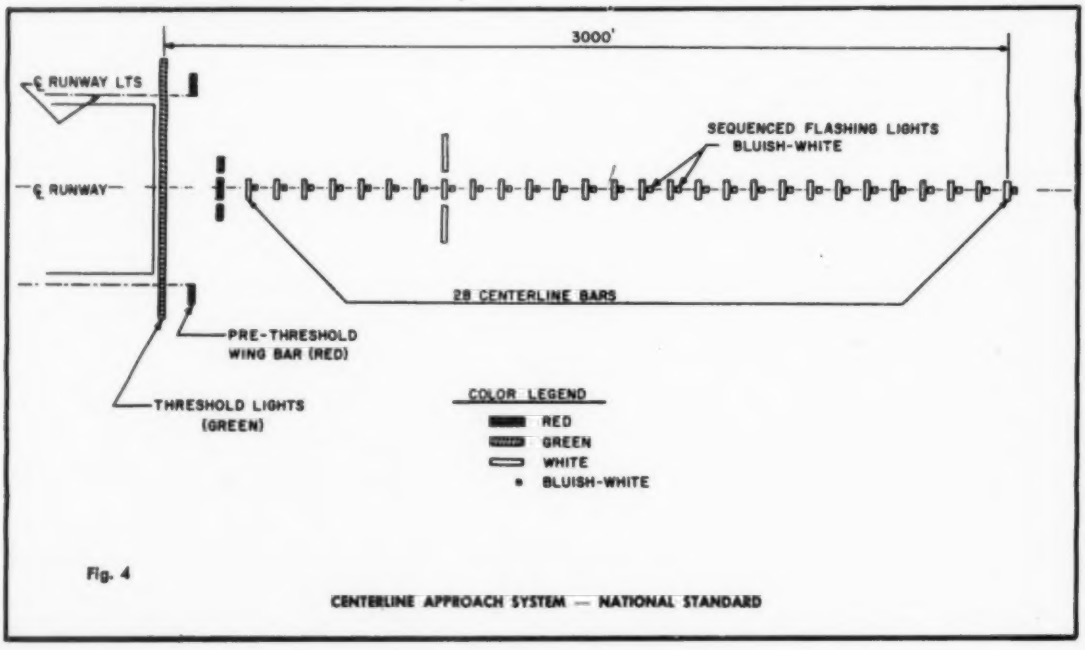


Fig. 4

CENTERLINE APPROACH SYSTEM — NATIONAL STANDARD

version and "C" configuration was the Navy version, e.g., the essence of non-standardization for an official standard.

The struggle did not end here. Conflicts between civil and military requirements arose at many joint civil-military fields to keep the pot boiling. Further evaluations and comparisons of Configurations "A" and "B" were then made at McGhee-Tyson Field, Knoxville, Tenn., in 1956 and at March AFB in 1957. Finally in April of 1958, military objections to the centerline system were withdrawn and Configuration "A" became *the* official U. S. Standard Approach Lighting System. At long last we had an approach lighting standard in more than name only and we could say, *"and then there was one!"*

With this development, the "A" system was enhanced with Condenser Discharge Sequenced Flashers (indicated on Fig. 4); all other lights being steady-burning high intensity with five brightness steps. The flashers are high candlepower units precisely timed to fire in sequence starting at the outermost light and ending at the innermost light. This sequence gives the appearance of a blazing ball of light speeding toward the runway at 3600 miles per hour, twice each second. This added feature permits earlier recognition of proper runway alignment as the flashers are normally observed several seconds ahead of the steady burning lights.

Studies indicate that from the time the outermost ALS bar passes below the cockpit cut-off point (15-degree cutoff) at a speed of 180 mph, 18.2 seconds remain to touchdown. To make a correction for a 40-foot displacement from the centerline requires approximately 10 seconds, leaving 8.2 seconds to prepare for touchdown. It is therefore evident that earlier recognition provides the pilot better than a fighting chance to safely avert a waveoff, if out of position when going contact on the approach. At this time all prior systems at major civil airports have been or are in the process of being converted to Configuration "A."

Let us now trace the trials and tribulations of the Navy in this evolution of approach lighting. The Navy during WW II utilized two parallel rows of red lights extending up to 2400 feet into the approach zone as shown in Fig. 5. This system may still be

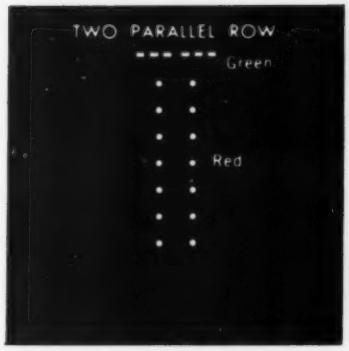
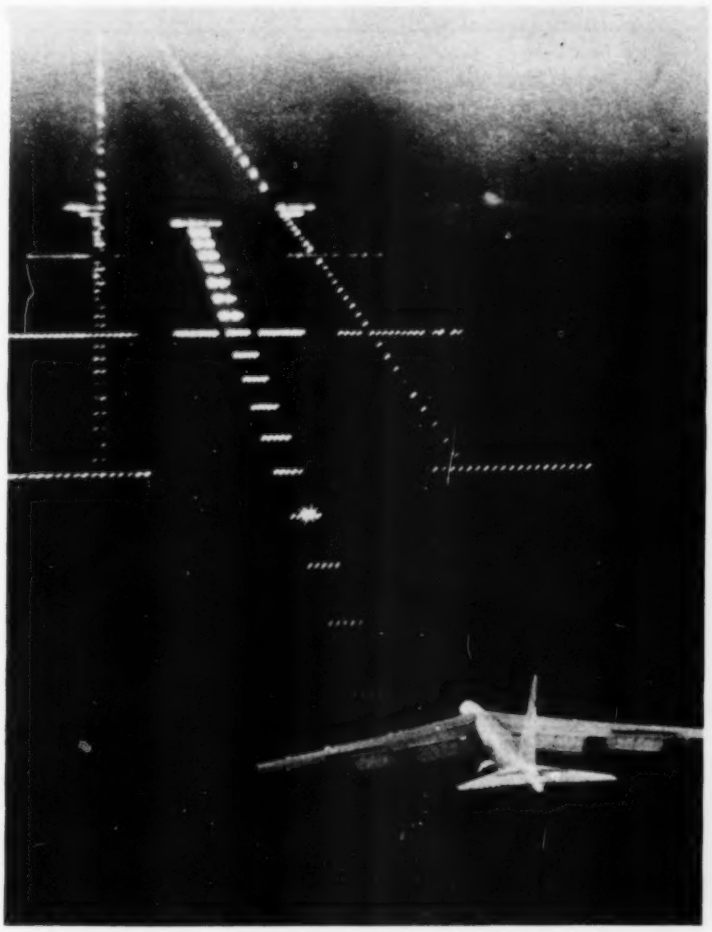


Fig. 5

The added bars can be seen in this photo of the March AFB approach system



seen at some Naval Air Stations. After WW II the Navy devoted considerable energy and funds to the LAES Arcata project and confidently supported the joint-committee's selection of the Slope Line System in 1949.

When the Slope Line System lost favor in 1950, the Navy embarked on its own evaluation program of several different types of approach lighting at Pax River in cooperation with the CAA. The Slope Line, French and British Calvert Systems were installed and test flown under all meteorological conditions. The latter system is shown in Fig. 6.

Out of this came the Navy configuration "C" (3 Line Composite System) of the 1953 U. S. Standard, Fig. 7. This system was permanently installed at the Pax River base. The Navy then rushed to install this system at numerous stations the following year. Before the installation program could get underway, however, someone pulled the plug and the whole program was scuttled. The Navy expeditiously developed another more conventional standard called the Parallel Row and Crossbar System, Fig. 7a, which saw limited installation up to 1958. The Navy subsequently participated in the

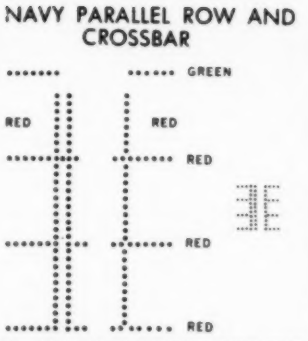


Fig. 7A

various evaluations of the center row system, but for the most part, adopted a wait-and-see attitude.

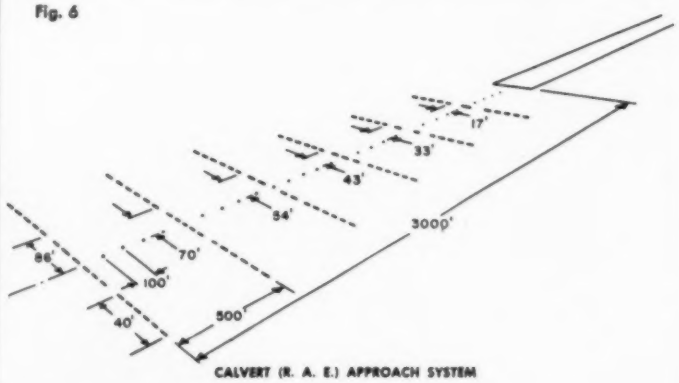
With the eventual establishment of the "A" Configuration as the standard in 1958, the Navy is now obliged to conform to this standard when constructing new approach lighting systems at naval air stations. In accordance with this requirement "A" configurations have been planned or are in progress at Oceana, Miramar, Beaufort, Whidbey Island, Cecil Field and Argentia.

The Air Force, like the Navy, started out during WW II with the parallel row approach light-

Fig. 8

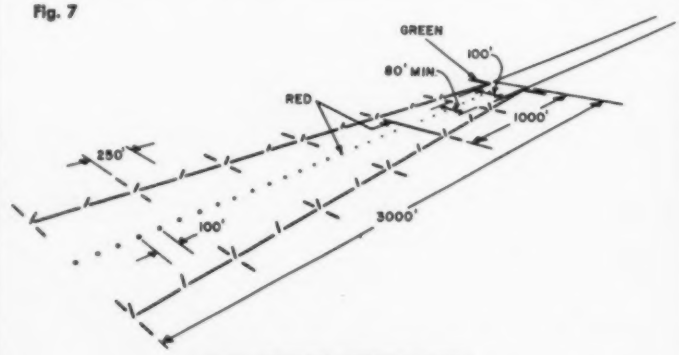
ing system, participating with enthusiasm in the LAES Arcata program. When the slope line standard dissolved in 1950 the Air Force returned to a high-

Fig. 6



CALVERT (R. A. E.) APPROACH SYSTEM

Fig. 7

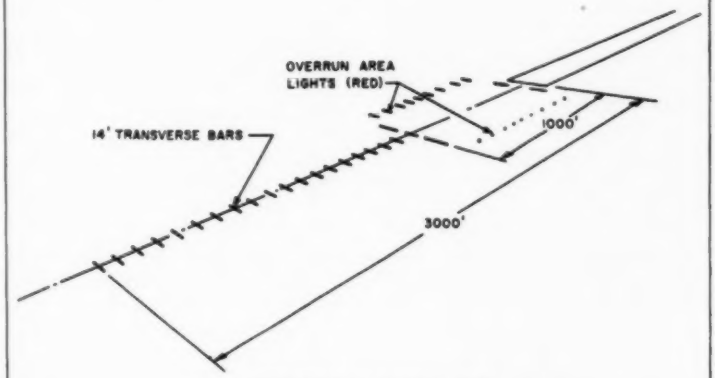


NAVY COMPOSITE APPROACH SYSTEM

intensity parallel-row system, Fig. 8, having 3-light bars on the left and single lights on the right out to 1000 feet from threshold. This system also served the dual purpose of indicating a usable overrun area and was labeled "Overrun Lighting System."

As the center row system gained favor, the Air Force adopted that portion of the "A" system from the 1000-foot crossbar outward as an adjunct to their 1000-foot overrun system thus creating Configuration "B", Fig. 9, as its contribution to the 1953 U. S. National Standard.

Fig. 9



CONFIGURATION B OVERRUN SYSTEM

As stated previously, this triggered new operational evaluations at McGhee-Tyson (1956) and March AFB (1957), eventually culminating in acceptance of the Configuration "A" System.

Thus it came about in 1958 that types "B" and "C" were deleted from the Standard of 1953 leaving one basic type "A" for both civil and military applications. The term basic is used because the standard permits the installation of additional roll guidance bars each 500 feet at the option of the installing agency.

Although the Standard specifies flashers down to 300 feet from the threshold, all flashers inside the 1000-foot bar are activated only when the steady burning lights of the system are raised to intensity 4 or 5, the two top brightness steps. The flashers may be turned off or the steady burning lights may be changed in brightness at the request of the pilot. The FAA is currently working on an intensity control device which will automatically change the intensity in response to changing meteorological conditions. It is expected to be operational in FY 1962.

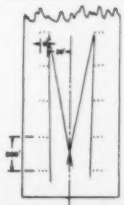
The Air Force's decision to adopt the complete Configuration "A" was due in large measure to the development of a successful flush approach light for installation within the overrun areas. Two types are presently available, the open-grid and the prismatic type. Evaluation reports favor the prismatic type for approach systems due to its greater beam spread, and that leads us into the still controversial area of runway touchdown zone lighting.

For many years runway edge lighting provided the only guidance for landing in low visibility or darkness, and for an equal number of years pilots complained about the "black hole" which existed between the rows of lights. With wider runways the situation grew worse as the runway lights moved farther outside the sensitive area of the pilot's eyes. The real crusher was the development and installation of the high intensity approach lights. A pilot coming in over the bright row of approach lights loses much of his dark adaptation when suddenly he crosses the threshold and *whammo*—no more lights, only a real black void. Hence the term "black hole" really made the news.

The first practical attempt to put lights in this dark hole was at the Schipol Airport, Amsterdam in 1956 using flush lights newly developed in the Netherlands. These were the open-grid type units. In 1957, at Soesterberg Airport, Netherlands the first integrated approach and runway lighting system was installed using the Calvert approach lighting system and the open-grid flush lights on each side of the runway centerline in the touchdown zone.

Subsequent flight evaluations of this system were made by pilots from Great Britain and the United States. The result was a joint civil-military test program at Andrews AFB in 1957 using the pattern shown on Fig. 10 and referred to as "narrow gage" runway lighting. The light units were simulated open

Fig. 10



Recommended narrow-gauge runway lighting—Andrews AFB (1957)

grid type laid on the runway surface to reduce the cost of experimentation.

Exact conclusions could not be drawn from the limited number of low visibility flights over the system but they led to increasing demands for such systems by pilots and plans were made by the Air Force to install narrow gage systems at Dow and Westover in conjunction with the Configuration "A" approach lighting.

These installations were completed in 1958 and the flight test phase ended in early 1959. The SAC report entitled "Integrated Visual Approach and Landing Aid" (IVALA) dated Sep 1959 gives an excellent account of the test environment, hardware, test procedures and results. The narrow gage consisted essentially of the configuration tested at Andrews AFB, using the open grid type light units.

The Dow and Westover tests resulted in Air Force acceptance of the narrow gage concept, together with plans for implementing the system at numerous Air Bases in the next fiscal year, and an Air Force recommendation to the Air Coordinating Committee that the system installed at Dow and Westover form the basis for a National Standard on runway touchdown zone lighting. (The Navy now has a 3000-foot narrow gage installation nearing completion at NAS Oceana.)

The FAA on the other hand has taken the stand that this is only one type of touchdown zone lighting which has proven to be operationally feasible from a military standpoint, and that there are other systems and configurations which may be better from the civil point of view. Several systems of touchdown lighting are now under evaluation at the National Aviation Facilities Experimental Center of FAA at Atlantic City, New Jersey. All Navy pilots who can are urged to visit the FAA Test Center at Atlantic City, New Jersey to familiarize themselves with the various types of landing aids being studied and assist if possible in their evaluation.

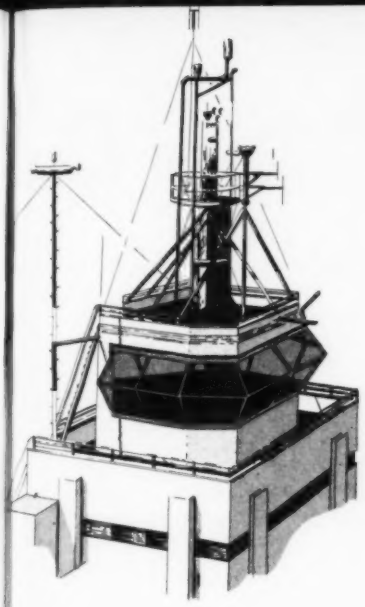
Until this test program has been completed by FAA there doesn't appear to be much chance for approval of the Air Force recommendation. Now then, once more the stage may be set for another multiconfiguration standard as in the earlier days of approach lighting. Let us hope such a situation does not develop, but that soon we can again say *"and then there was one!"*

Even though Configuration "A" now exists as the single system standard for approach lighting, we would like to caution all hands not to expect to find this system at every station for a number of years hence. These lighting systems are very costly, therefore their implementation will depend on availability of funds, manpower and time.

All flight planning should therefore include a check for the existence of approach lighting at the airport concerned. Consult the latest Directory of Airports for type and cross-check the letdown plate for configuration. The same caution applies to runway touchdown zone lighting.

It is still good advice to be familiar with all systems because a knowledge of their differences is as important as knowing that a system of lighting exists. ●

The research and writing of this article and also the one on page 24 of this issue was accomplished by CDR John J. Gallagher, USNR. He is a graduate of Brown University and worked in the Bureau of Yards and Docks prior to his entry into the Navy in November 1942. He was designated a Naval Aviator in August 1943. He joined FAA in 1946 and was assigned to the Systems Staff Division, Bureau of Facilities and Material, handling matters relating to airports and visual aids. CDR Gallagher has continued to participate in the active reserve, and maintained his active flight status until July 1958. He currently holds a valid commercial pilots license with S. E., M. E., instructor and instrument ratings.



PILOT CONTROLLER RELATIONSHIP

THE joint responsibility of pilot and controller is primarily to prevent collision between aircraft. The need for such activity goes back at least to 1917 when the Army Air Corps recorded its first mid-air collision.

Early forms of traffic control, utilizing ground personnel, consisted of dispatchers determining when airplanes of their airlines or other lines might conflict with each other, passing the information to the pilots, and hoping for the best. Today's system is more effective though more complicated. The future holds promise of greater efficiency through electronic automation.

With or without automation, the pilot and controller will continue to be the most vital cogs in the system and must thoroughly understand each other's problems and prerogatives. A pilot must realize that the controller is handling many aircraft and, except in emergency, cannot give preferential treatment to any single aircraft. A controller must realize that the pilot is operating in an environment which can change rapidly from good to bad and must receive prompt service on any request for a change in flight plan.

Both parties could benefit by spending time observing the other man at work. Pilots should visit control centers during IFR weather, and controllers should ride in cockpits during IFR weather. Not only would the individuals benefit, but so would the public, the FAA, and the airlines.

Although safety is the prime objective of the pilot/controller relationship, there is also the responsibility to move traffic expeditiously. The public is paying for speed when it uses aircraft. Any unnecessary delay cheats the public and increases aircraft operating costs. The pilot and the controller should never hesitate to forward information to each other that might accelerate the flow of traffic.

Both the pilot and the controller are professionals in their field and should respect each other as such. Differences of opinion should be resolved in technical meetings. The objective of such meetings must be to move traffic safely with minimum delay, rather than to substantiate personal position or glorify historic regulations and procedures. —

ALPA "Tech Talk"

You write the caption!

What a revoltin' development this is! And especially if the relief doesn't have a raft, and our law-abiding sentry can't leave his post until relieved. The object he's tied to and guarding is a head-on view of an aircraft's vertical fin—and we presume he's authorized to assume a sitting position on watch. How about YOU captioning this photo with words that this lone sentry is muttering to himself? And while you're at it, jot down a safety hint that you'd like to pass along to others. Send your caption and hint to APPROACH and we'll publish them in a future issue.

MONITOR

Merger Note

Various maintenance problems which formerly were the concern of Fasron, but upon integration with the Naval Air Facility became the concern of the Facility were considered. The reported shortage of work stands is no longer a shortage, the station allowance is filled. There was mentioned tendency of personnel to remove the guard rails on the work stands with its attendant reduction of safety factor. In this connection more supervision of working personnel is needed, to emphasize safety.—*NAHA Area*

FOD Control

The chairman called attention to the 16 cases of foreign object damage in the last 6 months within this Wing. This is not a healthy situation and it is directed that the causes be investigated and immediate action taken to correct them. One member recommended that areas adjacent to runways, taxiways and parking areas be coated with oil or some similar substance to prevent these foreign objects from spilling into aircraft areas.—*3rd MAW*

Location of Morest

The present location of the Morest unit at Iwakuni does not afford sufficient roll-out to get down to engaging speed required for F4D and F8U model aircraft. Therefore it was recommended that it be moved nearer the midpoint of the runway.—*1st MAW*

Sweating It Out

Individual squadron flight surgeons have undertaken a program to get lemonade or some comparable liquid included in the flight rations of the patrol flights crews. During periods of very hot, humid weather, the coffee normally furnished is not adequate to combat the moisture losses from the body. This will be reported upon at the next meetings.—*FAirWingSix*

Current Weather

The Operations Officer reported the implementation of a system for transmitting the latest weather to aircraft making actual Ground Controlled Approaches. When Idlewild Approach Control advises NAS GCA that an aircraft will be handed over to them, GCA requests from aerology a weather observation be taken at the time of the handover. This information is transmitted to the pilot of the aircraft. Then, just prior to the aircraft turning final, another observation is taken and is relayed to the aircraft. It is anticipated that this system will eliminate instances during marginal weather when conditions change so rapidly that the weather information passed to the pilot is obsolete five minutes later.—*NAS New York*

EXCERPTS FROM SOME OF THE NAVY'S SAFETY COUNCILS THROUGHOUT THE WORLD, WHO PROVIDE LOCAL LEADERSHIP AND EMPHASIS TO THE NAVAL AVIATION SAFETY PROGRAM.

Complete Checklist First

In a discussion on the present CCA pattern and its relationship to the final approach it was reported that many pilots are being turned over to the LSO when they are not really set up for a landing. The biggest fault noted is that the check-off list hasn't been completed. It was decided that the instrument officer would draw up a standard approach plate showing CCA pattern, altitudes, airspeeds, and where the check-off list should be complete. This plate will then be printed and given to the pilots.—*VS-21 Safety Committee*

Flight Attire

In spite of hot weather flight operations, pilots and crewmen must be appropriately attired in flight suit with gloves so that the least amount of the body is exposed to possible fire hazards. Flight personnel will be closely supervised to insure that they are properly dressed during flight operations and that they remain so during the course of the flight.—*Accident Prevention Committee, Willow Grove*

Frustration Control

Discussed emotional behavior of pilots after coping with unexpected delays in departures, errors in servicing, difficulties in understanding and copying clearances and other upsetting factors in aircraft operations. Pilots must not let these irritating events interfere with judgment and performance in controlling the aircraft. Pilots must learn to accept such events in good faith and forget them until safely on the ground and out of the aircraft and only then report them to proper authority.—*NATechTraCom*

Helo Hot Wx Performance

With the advent of hot weather, the problem of helicopter takeoffs and landings under conditions of little or no relative wind assumes greater proportions. Under such conditions the density altitudes increases which adversely effects performance in two ways. First, the engine is less efficient. Second, the rotor blades are operating in air of less density and consequently the lift factor is reduced. These two features of hot weather operation can be offset by providing sufficient relative wind to produce a safe margin of translational lift. Without translational lift, military-rated power is usually required for takeoff. Such demands on the engine obviously can only result in reduced engine life or possible failure. It is recommended that the Air Officer brief underway OODs, JOODs, and CDOs on the problems of hot weather helicopter operation relative to wind over the flight deck.—*USS* VALLEY FORGE

COMMON SENSES

As long as Man, Mk I, Mod 0 (earth-walking design) leaves his natural habitat and is confronted with the problems of physical orientation in three dimensional space in flight, he will be subject to vertigo. Ask your flight surgeon to discuss vertigo at a squadron safety meeting. The more you know about vertigo the better off you are. In the meantime, APPROACH presents two reports from the Naval Aviation Safety Center's files and an excerpt from a study by the U. S. Naval School of Aviation Medicine in the hope of promoting general discussion and exchange of experiences and methods of coping with the ever-present problem of vertigo.

Report 1: The flight, a two aircraft section HurEvac, was briefed for VFR at 38,000 feet. During climbout, the pilot of the second FJ3 realized that he was pressure breathing and that he had no cabin pressurization. He so advised his flight leader, but because they anticipated no difficulties they continued the flight.

Thirty minutes after takeoff, they reached an altitude of 43,500 feet. At this time, the pilot reported to the leader that he was having a pain in his left arm which he believed to be the bends. After maintaining flight level 435 for 15-20 minutes a letdown to 36,000 feet was made. At this altitude the pain subsided. When they ascended to 38,000 feet to stay above the haze, the pilot felt considerable pain throughout his body. (For the purposes of this article we will restrict our discussion to the vertigo aspects of

this accident with no comment on the pilot's failure to descend immediately at the onset of the bends, his reascent to altitude and his failure to declare an emergency when the bends recurred.)

Ten minutes from destination as the flight was proceeding straight and level, the pilot experienced severe vertigo. He described it later as an illusion that his instruments were rotating rapidly in front of him in a vertical plane.

The pilot's responses to his vertigo situation were all the wrong ones.

First, he moved closer to the lead plane and, in the darkness and poor visibility, fixed his gaze on the two visible navigation lights of the flight leader's aircraft. His vertigo became worse. Instead of scanning his instruments, he fixed his eyes on his turn and bank indicator exclusively. He stated later that when the cockpit seemed to be rotating rapidly, he was in a shallow left bank and losing altitude gradually. He was of the opinion later that he must have overcorrected because the bank and the loss of altitude increased rapidly. Meanwhile he informed his flight leader that he had vertigo.

The flight leader instructed him to go on instruments immediately, to forget everything else, that he would keep him in sight. He also told the pilot that he appeared to be straight and level and all right as far as he could tell.

The pilot replied that he was not all right and that he was "bailing out." He had made up his mind that if he was not oriented at 20,000 feet, he would abandon the aircraft. At 20,000 feet he was still experiencing vertigo—he ejected. The cause of the accident was determined to be "aviator's vertigo and the ensuing loss of control of the aircraft by the pilot."

Report 2: Deck launch of the ADs for the evening flight was at 1730 just before sunset. The LTJG was the third one off and joined up uneventfully. It was soon discovered that at a distance further than five miles from the ship sustained radio contact was impossible and the low visibility intercepts which had been planned would have to be delayed. As it was still light, the ADs engaged in a practice tail chase. By dark, the radio reception had improved, and the section split up to begin the night intercept exercises.

One of the pilots in the formation later described the night as the darkest in which he had ever flown. "There was absolutely no visible horizon, no moon and only your instruments or the plane you were flying wing on to give you any reference to your actual attitude in the air," he stated. Intermittent unseen cumulus clouds interrupted visualization of the stars, rendering them unreliable, almost treacherous, for attitude evaluation. Both sections flew into clouds inadvertently because of the poor visibility.

As the pilot's position on the flight leader's wing was changing, the JG did not realize what was happening. He made no corrective movements. He watched his relative position change almost dumbfoundedly. Then he projected his dilemma onto his flight leader by thinking that the flight leader was the one who had vertigo. The JG felt as if the flight leader was split-S-ing into the sea. Later he reported that "stars were above and below me."

At about this time, he executed the correct procedure in attempting to go on his gages. However, he apparently was so confused he was unable to evaluate his attitude or to concentrate rationally. He felt as if he were spinning. This sensation, the reporting flight surgeon states, must have been true spinning vertigo because from subsequent events it seems unlikely that the aircraft was actually in a spin.

Disoriented and believing himself in a spin below 5000 feet, the LTJG was for all practical purposes psychologically frozen for a few seconds. At this point, he opened the canopy, unbuckled and began his unsuccessful attempts to bail out. The wind caught his arm while he was holding the parachute D-ring, and the parachute opened while he was still in the cockpit. Knowing that a successful bailout was now virtually impossible, he managed to regain control of his plane. Attempting a landing aboard ship, he experienced a second attack of vertigo in which he felt as if he were flying upside down and standing on his head. This time, he quickly went on his gages and was able to control himself and his aircraft with only minimal loss of altitude. His flight leader then led him to the beach where both aircraft made uneventful landings.

(The pilot's own account of this flight—his attempted bailout and finally his successful landing of the plane—appeared in an article entitled "Just Call Me Lucky!" in the June 1960 issue of APPROACH.)

In the following excerpt from a study of disorientation by the U. S. Naval School of Aviation Medicine,* you may find additional material for a vertigo discussion. For the purposes of the study quoted, the authors define aviator's vertigo as spatial disorientation in which the pilot's experience does not correspond with objectively verifiable physical events.

"The major tasks of the pilot are fundamentally perceptual in nature. He needs to know his position in space at all times during flight so that he may know what to do next. That any threat

* Research Project No. NM 001 110 100.39

to proper orientation is of immediate interest to the pilot is shown by the wide interest in disorientation exhibited by both pilots and flight surgeons. Accurate information concerning disorientation is important for all fliers, particularly student fliers, but at the same time the possibility of disorientation should not be overemphasized. Proper orientation is the rule, and although nearly all pilots do become disoriented at one time or another, a critical situation is almost always avoided. It is possible to prevent most of the disorientation when it does occur. On the other hand, there is no simple cure for it since the factors producing disorientation are many, varied, and complex, and they result from normal psychophysiological mechanisms operating in an unusual environment.

"Some of the major factors which contribute to disorientation are:

"1) The dominant factor contributing to disorientation either to the plane, the earth, or other objects in space is the reduction of visual cues by darkness, rain, or fog. Disorientation rarely occurs without it.

"2) Inexperience with instrument flight is another factor and, of course, failure to use the instruments under instrument flight conditions.

"3) Conflicts between the cues to orientation contribute to disorientation. This may result when there are conflicts between visual and gravitational cues, but the significant factor is a conflict between the senses and the instruments.

"4) Prolonged fixation on isolated targets particularly at night while flying the wing position. This is conducive to the occurrence of autokinesis.

"5) Prolonged constant speed turns at night particularly with rapid recovery to straight and level flight. This produces an optimum condition for the illusory effects associated with the semicircular canals.

"6) Unusual maneuvers at night predispose the pilot to disorientation. This is true because of the effects of the G receptors and the semicircular canals and also due to the fact that it is easy for the pilot to fail to follow his position in space accurately.

"7) Fictitious horizons whether due to visual or other causes may predispose the pilot to be confused with regard both to his attitude and altitude.

"8) Gradually entering a turn without the pilot's knowledge of it. This may cause disorientation itself, but it may contribute to dependence upon a fictitious horizon.

"9) Sudden accelerations and decelerations at night. These produce resultant G in unusual directions.

"10) Failure of the pilot to keep track of his position on a three-dimensional map.

"The prevention and cure of disorientation is dependent upon adequate visual cues and avoiding certain conditions of flight listed above. However, it is useless to say, 'Fly only VFR and never perform unusual maneuvers.' Furthermore, merely to say, 'Trust your instruments' does not solve the problem either. Pilots know perfectly well that they should trust their instruments, but when the pilot 'feels' strongly that he is rotating to the left while the instruments indicate a right turn, it requires a great deal of mental discipline to disregard the sensations he has been trusting all of his life. Therefore, disorientation may be expected to recur and sometimes result in improper action. Some of the procedures to reduce vertigo which have been found to be useful in particular situations are listed below.

"1) Develop skill in the use of instruments. Although these can never fully replace direct visual cues, they are remarkably effective in all sorts of situations. If the pilot follows them skillfully, even though disorientation occurs, he will always know what to do next.

"2) Knowledge of the fact that disorientation may occur and the types of experiences which may be encountered. Then, the pilot is less likely to be caught off guard.

"3) Turning the aircraft over to the copilot, where possible, has been found to be an effective way to get rid of vertigo . . .

"4) Maintaining either instrument or contact flight but not mixing them helps avoid disorientation.

"5) Avoiding night acrobatics will eliminate one important factor contributing to disorientation. *(This, of course, is not applicable to simulated night weapons delivery.—Ed.)*

"6) Autokinesis can be reduced by not staring at lights and by using a sighting device on the wind screen to check the motion. In training, proper lighting of the aircraft will also tend to reduce autokinesis, as well as the oculogyral illusion.

"7) Avoid leaning over in the aircraft to pick up something when the aircraft is in a turn at night to reduce the chances of Coriolis effects.

"8) Fascination may be reduced by shifting the attention from one item to another in the perceptual field rather than concentrating on one thing.

"9) It is important that the pilot learn to depend upon the proper cue to orientation. During contact flight this will be direct visual cues, and when direct visual cues are inadequate, the instruments will serve as the best cue for orientation. A knowledge of the advantages and limitations of the various cues to orientation should reduce disorientation by a substantial amount." ●

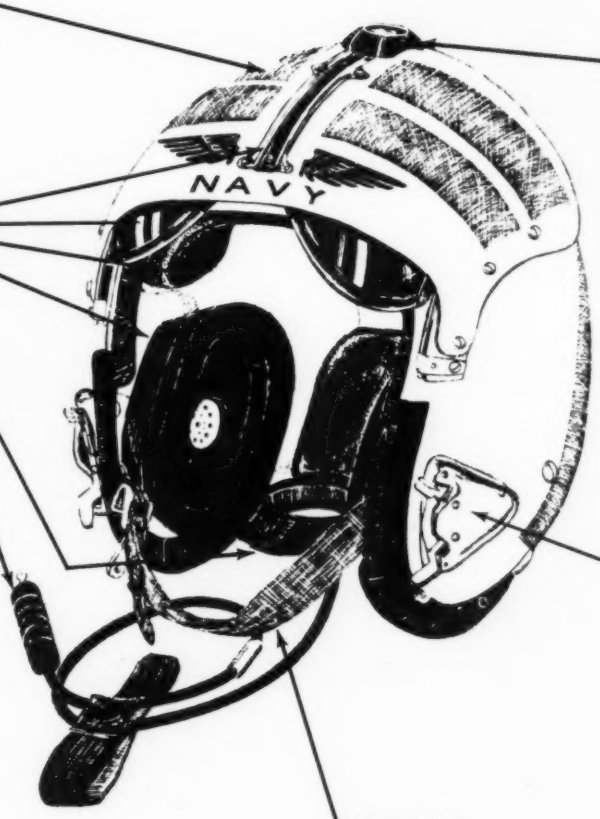
BACSE
PROTE
METS,
OF RE
TO IN
TECTA

BACS
HELM
PILOT

APH-5
HELMET

BACSEB 1-60: PILOTS' PROTECTIVE HELMETS, APPLICATION OF REFLECTIVE TAPE TO INCREASE DETECTABILITY.

BACSEB 24-58: HELMET, PROTECTIVE PILOTS', TYPE APH-5.



BACSEB 19-59 HELMET, PROTECTIVE, PILOTS' TYPE APH-5: MODIFICATION OF BUTTON AND VISOR HOUSING ASSEMBLY.

BACSEB 17-58: OXYGEN MASK: HARDMAN 3740, RETENTION KITS FOR APH-5 HELMETS: INSTRUCTIONS FOR INSTALLATION.

BACSEB 17-58A: REINSTALLATION OF CHIN STRAP.

DOES YOUR APH-5 HELMET HAVE ALL THESE UP-TO-DATE MODIFICATIONS? IF IT DOESN'T (AND FROM INFORMAL OBSERVATION, WE'D SAY MORE DON'T THAN DO) *YOU* ARE THE ONLY PERSON WHO CAN UNLOCK THAT CAR TRUNK OR GEAR LOCKER AND MAKE SURE YOUR HELMET GETS TO THE RIGGERS IN THE PARACHUTE LOFT. NOBODY ELSE IS GOING TO DO IT FOR YOU. REMEMBER, FORESIGHT IS A HEAP SIGHT FINER THAN HINDSIGHT! DO IT TODAY!

FIRE PROTECTION

WHEN the port engine of the S2F-1 failed immediately following takeoff during night field carrier landing practice, the aircraft crashed into the trees, inverted and caught fire. The fuselage was broken aft of the pilot's compartment with the forward portion rotated about 90 degrees, making both pilots' escape hatches accessible. The copilot was able to escape from the aircraft. The pilot was pinned in the wreckage by something holding his left foot.

The crash crew arrived promptly and attempted to rescue the pilot from the burning plane. The following description of subsequent events is taken from the eye-witness narrative of the officer-in-charge of the auxiliary landing field:

"I arrived at the scene and saw the S2F on its back, facing in a southerly direction. The cockpit had twisted or sheared off from the fuselage and was lying on its port side. The pilot was visible through his overhead hatch. Both hatches were missing. The copilot was not in the cockpit.

"I dropped on my stomach and reached in to check or loosen his belt and shoulder straps . . . The others at the cockpit were alternately spraying Ansul bottles, CO_2 extinguishers and trying to help dislodge the pilot. He appeared to be pinned by the feet or legs as we were unable to move him.

"There were two explosions while we were at the cockpit. With the last one, flames moved up to the cockpit forcing us to stop work on freeing the pilot. We used the remainder of our extinguishers trying to stop the advancing flames. The hand extinguishers were not enough. All of us were forced to back away due to the intense heat. It was at this point I felt we were going to lose the pilot.

"Suddenly, one of the fire fighters dashed into the cockpit area. He was on his knees, pulling on the pilot when the de-icer fluid tank let go. A green wall of flame seemed to roll over the entire cockpit area blotting out the firefighter and the pilot for a second or two. Out of this inferno

came the firefighter. He was completely ablaze. He staggered about 10 to 15 feet and collapsed. Several of us dashed over and, grabbing fire coats, jackets and Ansul bottles, attempted to smother the flames on him.

"At this point, some one yelled 'The pilot is crawling out.' I turned and could see the pilot about three-quarters of the way out of the cockpit, crawling very slowly. Someone attempted to dash in, but had to retreat again due to the intense heat. A broom was extended in to the pilot but it burst into flames before he could grasp it. His anti-exposure suit was burning. As he crawled out far enough, he was pulled to safety, his suit was cut off and he was taken to the ambulance."

The heroic firefighter died in the hospital several days later of third degree burns. He was credited with saving the pilot's life.

The pilot suffered 1st, 2nd, and 3rd degree burns, three fractured vertebrae and a broken left foot.

The pilot's Mk V anti-exposure suit protected him in a fire so intense it drove firefighters back. The anti-exposure suit was burned and adhering to the inner liner in many places but especially on the back of the trunk, legs and crotch. The inner liner of the suit was burned only where it was in contact with the burned areas of the anti-exposure suit. There did not appear to be any internal combustion of the inner liner. Although the suit was burned away in many areas and melted away in others, it was thought that the intensity of the fire exceeded the fire-retarding limitations of the suit. The pilot's Mk II life vest was found to be burned through all compartments on the back section as well as on the inner side of the front sections.

Obviously, in a fire so intense it ignited a broom extended to the escaping pilot as he crawled from the burning wreckage, the protection offered by the anti-exposure suit can be credited with saving the pilot from burns as serious as those of his heroic rescuer.

Grease Spot

AN HUS was being towed out of the hangar to the flight line, tail first, by a mule driver. A helicopter mechanic, who was to be a passenger in the aircraft on the up-coming flight, attempted to place his gear in the 'copter while it was being towed. He slipped on a grease spot on the runway and was caught by the right main gear which rolled over him. He sustained critical injuries.

Personnel who work around aircraft should be continually rebriefed about the hazards that may be encountered and aircraft handlers can be alerted to turn away any approaching unauthorized personnel to prevent accidents of this particular type from recurring.

Locked Forward

AN INSTRUCTOR in the rear cockpit and a student pilot in the front cockpit of a T-34-B were on a primary pre-solo flight. While the instructor was demonstrating a simulated low altitude emergency, the engine failed. The aircraft struck the ground, bounced, struck the ground and bounced again. Fire broke out on final impact. The student pilot received a fatal skull fracture. The instructor who sustained moderately severe injuries was able to evacuate the aircraft. He was burned as he attempted to remove the student from the cockpit.

The reporting flight surgeon states that the failure of the two men to lock their shoulder harnesses was undoubtedly a major factor in the death of the student and the injury of the instructor. Both men, he states, were thrown forward, their heads hitting the sticks in their respective cockpits in almost identical positions. The instructor suffered only a concussion because his APH-5 helmet struck the stick. His smaller stature and the fact that his APH-5 helmet stayed fastened more securely and came down lower over the forehead were possibly deciding factors in the extent of his injuries. The student, on the other hand, wearing an H-4 helmet and more than 6 feet tall, was struck in the forehead below the brim of his helmet.

The reporting flight surgeon recommends that "shoulder harnesses be kept locked at all times except when absolutely necessary to unlock them, and further, that definite checks be made to see that the harness actually is locked. Although a landing check-off list should be completed on each high and low altitude emergency," he continues, "the suspicion exists in this investigator's mind that a few instructors and students not anticipating a landing in such cases are mainly concerned with their progress in the pattern and fail to check their shoulder harnesses. It is further believed that some aviators occasionally unlock their harness when they think they are doing the opposite."

The statement that the "harness is LOCKED FORWARD" is a good one in the reporting flight surgeon's opinion: The aviator should check to see that the inertia reel lock is in the forward position and then should attempt to lean forward in order to double-check this. ●

More Light on the 'Black-Hole' Problem

THE *Cessna* 310 purred like a basket of tigers. It was night . . . pitch blackness pierced by a few pinpoints of starlight and the occasional lightning that flickered from distant cloudbanks.

We were a little more than a mile from the end of Navy Norfolk's runway 28. Instead of the normal runway approach lights and marker lights only a black piece of real estate appeared ahead.

"Cessna 78 Cocoa . . . cleared to land . . . gear down and checked," called the Navy tower.

Still no lights on the airport.

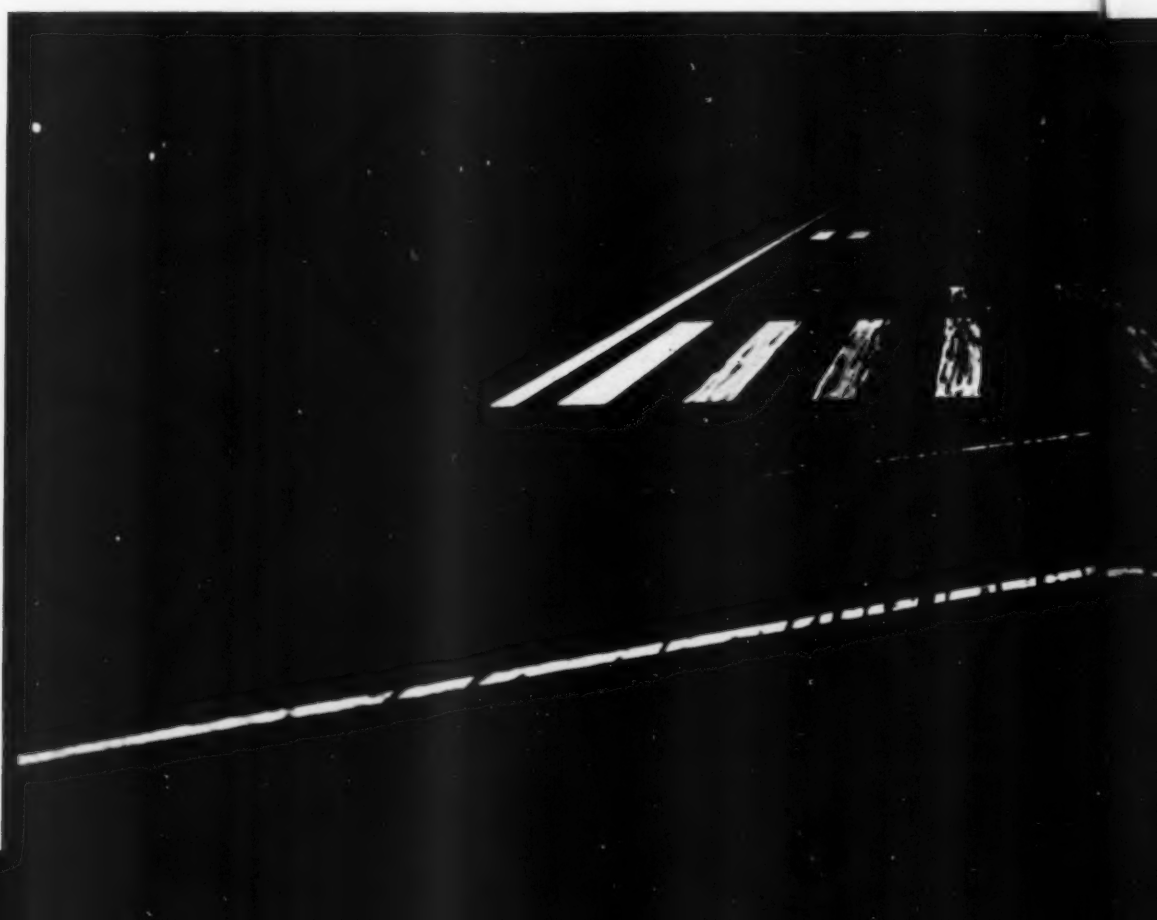
A flip of the Cessna's landing light toggle switch . . . and runway 28 seemed to burst into a white blaze of light. The threshold markings, the 2-foot wide center line and the 2-foot wide runway boundaries were etched onto the dark runway with fierce intensity.

And, the white markings extended for more than 2000′ down the runway and with lesser intensity as far as the landing lights could reach.

The 310 continued its approach to the runway. The plane's landing lights were switched off. Instantly, the runway markings vanished into complete blackness.

Again the landing lights, the 250 candlepowered jobs, were turned ON. Instantly the runway leaped again into life, clearly outlined in vivid white, for its full 7350′ length.

Threshold markings coming up—bright and clear. Ease back on the yoke and sc-r-e-e-ch, the main gear went onto the runway. Down the runway . . . for 3000′ . . . the center line and border



by
William K. Lawton
Executive Director, National
Business Aircraft Association

This informal report deals with a possible economical solution to the IFR night landing problem—the "black hole" at the end of the approach lights and center-line roll-out guidance.

stripes looked like Broadway on New Year's Eve.

Off again . . . down the runway at 50'. With the landing lights as our only source the runway was clearly outlined until the threshold markings zipped below us and out of sight.

Around once again. This time at about 30 degrees off the runway the landing lights were turned on as the 310 swung on to final about a mile out.

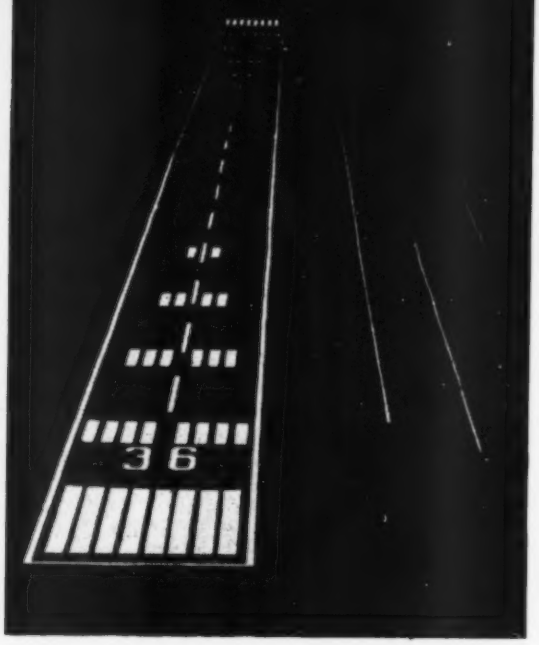
From the black pit of the airport, faint markings began to appear marking the edges of the runway. As we came closer onto final heading again the threshold markings, center line and border markings flashed into brilliant white.

Again the landing was accomplished with no groping or feeling for the last couple of feet. Once more we had several thousand feet of center-line guidance to smoothly accomplish the roll-out after touchdown.

What we had just flown through was the first non-military demonstration of a new process which may safely and economically eliminate the "black hole" runway problem.

Developed by Minnesota Mining and Manufacturing Company, and to be introduced under the name of "Scotch-Rok," this new runway marking method has just finished an intensive year-long evaluation by the U. S. Air Force at Richards Gebauar AFB, Missouri.

Essentially, it is composed of fine rock aggregate—tiny particles of granite treated with highly reflective material and mixed with a binder—which



Is this *the* answer to the black hole runway problem, or is it *an* answer?

is applied with conventional runway striping equipment.

These tiny rock particles literally stand on edge in the heavy binder providing a mirror-like intensity reflection of the aircraft's landing lights. Even heavy concentrations of rainwater standing on the runways fail to appreciably dim their brilliance.

After a 10-month test, the Air Force reported that the processed aggregate had retained 50 to 70 percent of its original reflective brilliance; that daily runway vacuuming did not adversely affect the material; that snow plows had no serious effects on the markings; that jet blasts did no material damage and that tireskid markings were the only major cause for more than annual maintenance.

Is this *the* answer to the "black-hole" runway problem, or is it *an* answer?

At the present time, the national standard for approach lighting calls for 3000′ of high intensity centerline approach lighting augmented with stroboscopic beacons. Recently, recommendations were made for high-intensity flush lights to be installed in a narrow gage track system down the first 3000′ of runway. With this latter system the pilot would be able to receive depth guidance and a path of light on which to land the aircraft.

Installation of this flush light system can be very expensive because existing runways have to be torn up and the flush lights inserted therein. Further, the cost of these flush lights is many times higher than other standard airport lighting.

This made it apparent to the military that a high performance marking material of some type was necessary; a highly reflective type of material that would, in effect, give the pilot a path of light reflected from his own landing lights under both VFR and IFR.

From this necessity came an evaluation which resulted in favorable consideration by the Air Force of the reflective aggregate as produced by Minnesota Mining.

The advantages of this type of reflective runway marking, which—as the old advertising slogan goes "even works under water"—seems to have all of the advantages of the many presently recommended narrow-gage, flush-button lighting systems plus avoiding many of the costly disadvantages:

No airport power supply needed. No airport runways to close down for months to install a lighting system. No costly electrical wiring system. No costly series of lights and fixtures to install. No daily maintenance by skilled personnel, simple runway cleaning.

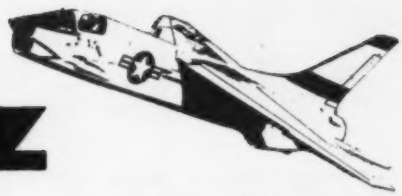
On the other side of the ledger (estimates cheerfully given) it is indicated that the initial cost of application for a 6000′ runway will be about $10,800 (materials only), which includes acid bath preparation treatment, 2′ wide center line, 2′ wide border stripes, 16 threshold markings 6′ wide by 150′ long, and runway numbers on both ends of the runway.

Compare these figures with the hardware only costs of the center line guidance flush-button system now installed at a major airport—and highly recommended by aviation runway lighting experts —estimated to have cost $14,000.

Added to the Configuration-A approach lights, this gives a total hardware cost of $82,500 for the full blown system which is now currently endorsed.

Approach lights, as currently established under Configuration-A with strobe augmentors are still, we believe, the best answer to low visibility approaches. It will, obviously, take more than high-powered landing lights plus highly reflective runway paint to give good runway line-up guidance when split-second maneuvering is required at low approach altitudes. And atmospheric attenuation in the order of a half mile visibility or minimum RVRs may preclude the use of landing lights.

However, when you consider the greater number of airports where night landings are made under average weather conditions, where visibility and ceiling limits are high, then the reflected light runway markings system's economy becomes increasingly important. — *Courtesy "SKYWAYS" magazine* ●



WHIZ QUIZ

1. If you are on an IFR flight plan and conditions are VFR over the route, you must, in addition to making position reports, also

a. report altitude when climbing or descending.

b. maintain course, speed, and altitude, since ATC provides traffic separation from other IFR traffic.

c. assume responsibility for avoiding other aircraft while operating in VFR conditions.

d. notify ATC upon encountering actual instrument conditions.

2. An ATC clearance to "maintain VFR on top" assures you

a. adequate separation from IFR traffic only.

b. adequate separation from both IFR and VFR traffic.

c. no traffic separation from either IFR traffic or VFR traffic.

d. adequate separation from VFR traffic only.

3. A pilot flying at flight level 240 or above on a VFR "on top" clearance must advise his flight level occupied in all position reports and advise ATC prior to effecting altitude changes. True or False?

4. The next fix along your route of flight was not mentioned on your form DD-175 and has the symbol △ on your chart. This indicates that you:

a. need report position only if requested to do so by ATC.

b. must give a position report when over this point.

c. must call ATC and request a new altitude.

d. must hold at this point and request new clearance.

5. On your chart you notice 2 minimum altitudes are indicated: 6400 and *4400. In this case *4400 feet represents the minimum:

a. Crossing altitude

b. Reception altitude

c. Obstruction clearance altitude

d. Enroute altitude.

6. Referring to the question above, the altitude 6400 feet represents the minimum:

a. Crossing altitude at a radio fix at which an aircraft must cross when proceeding in the direction of a higher minimum altitude.

b. Enroute altitude which assures adequate navigational signal coverage and meets obstruction clearance requirements.

c. Obstruction clearance altitude, which may be used in an emergency, or when within 25 miles of the VOR station being used.

d. Reception altitude, which is the lowest altitude at which signal reception is adequate to determine specific VOR fixes.

7. When statements of time are included in communication between air traffic control facilities and aircraft they shall be in terms of

a. Local time & based on the 24 hour clock.

b. Daylight Saving time and based on the 24 hour clock.

c. Greenwich Mean Time & based on the 24 hour clock.

d. Local time or Greenwich Mean Time.

8. When flying at or above flight level 240 your altimeter shall be set at

a. current reported altimeter setting

b. 29.92" hg.

c. Departure station altimeter.

d. Destination station altimeter.

9. Separation between aircraft within a formation is the responsibility of:

a. the tower

b. Air traffic control

c. Formation Commander

d. Squadron Commander

10. An aircraft operating within a High Density Air Traffic Zone, barring particular aircraft operational limitation, shall not be flown in excess of

a. 200 knots IAS

b. 150 knots IAS

c. 160 knots IAS

d. 200 MPH IAS

Answers to Whiz Quiz

1. b. and c. All ATC clearances must be strictly adhered to (emergency conditions excepted), however changes may be requested through ATC.

2. c.

3. True—ATM-2-A (which replaces ANC/PCAT) 272.3 "Pilots on IFR flights operating at or above flight level 240 in accordance with clearances which specify VFR conditions 'on top' will include actual flight level being occupied at the time required position reports are made and advise appropriate air traffic control facilities prior to effecting altitude changes."

4. a. This symbol indicates a non-compulsory reporting point.

5. c.

6. b.

7. c.

8. b.

9. c.

10. c.

VISUAL GLIDE PATH INDICATORS

by
CDR John J. Gallagher
Systems Staff Division
Bureau of Facilities and
Material
Federal Aviation Agency

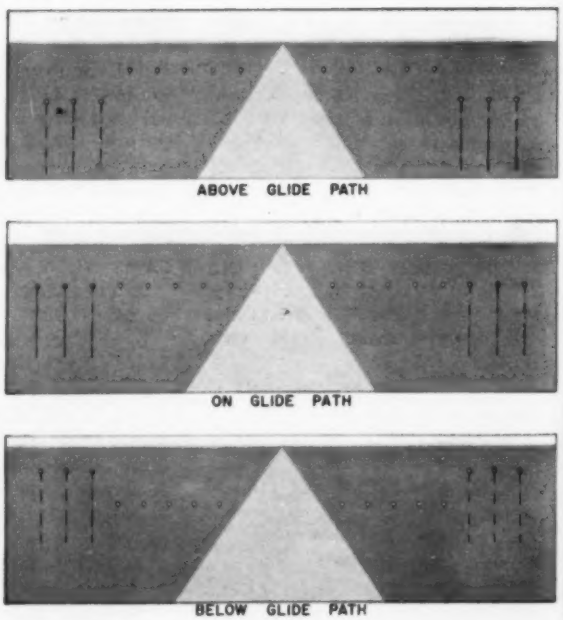
A VISUAL Glide Path Indicator is a gadget which if properly designed and oriented will enable you to accurately fly your plane down to the runway touchdown point by means of a visual light signal or pattern of lights.

No matter what the indicator looks like or what it's called, no matter how many kinds or colors of lights it has, all such systems are based upon a simple, ancient principle that you learned somewhere around the toddler age—if you line up your eye with two other objects, you establish a straight line (glide path), and any deviation from the straight line becomes evident by a change in the lineup of the two sighted objects. You do this unconsciously when you aim a rifle, and when you line up the radiator ornament of your classic Duesenberg with some part of the road.

A glide path indicator can be set so as to approximate the ILS glide slope or whatever angle of approach is desired. All designs to date establish a fixed glide angle for the particular airport or carrier; however, it appears feasible that such devices could be designed to permit variation of the glide angle upon pilot request.

To Navy pilots this may be old stuff, what with the widely used Mirror Landing System. You may not however understand some of the other types

Fig. 1 **DOUBLE BAR SYSTEM**



The Navy's mirror is only one of five visual approach aids which the FAA has been evaluating at Atlantic City . . . all five systems were designed to guide the pilot down a fixed glide path to the desired touchdown point.

to be seen in the U. S. and abroad. The purpose of this ditty is to provide a short description of these systems and their interpretation in the event you attempt to use one of them on short notice. For our many non-pilot readers we shall incorporate the Navy mirror system to make the story complete.

Double Bar—This is better known as the Australian or Cummings-Lane System composed of a bar of six amber lights in the foreground, three on each side of the runway, with a bar of 10 white lights in the background, five on either side. When on the proper glide path both bars are aligned; however, when high the white bar appears high; conversely, when low, the white bar is low. This system is illustrated in Fig. 1.

Tri-Color—A system of American manufacture consisting of two light projectors placed on either side of the runway emitting three segments of a flashing light. Your position on the glide path determines the color of the light seen; green indicates on glide path, amber for above and red for low. The unit on the left is set one-half degree higher than on the right to obtain a more pronounced rate of displacement indication. This system is illustrated in Fig. 2.

Red-White—This is known as the Calvert or British system and consists of 12 box-type light

Fig. 2

TRI-COLOR SYSTEM

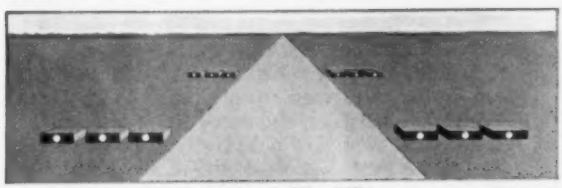
ABOVE GLIDE PATH

ON GLIDE PATH

BELOW GLIDE PATH

Fig. 3

RED-WHITE SYSTEM



ABOVE GLIDE PATH

ON GLIDE PATH

BELOW GLIDE PATH

sources, 6 on each side of the runway which produce pairs of either red or white lights, depending on your glide path position. When on the glide path, the forward boxes appear to emit white light with the rear boxes producing all red. The rate of displacement is given by a transition zone of pink in the bar affected; i.e., as the aircraft goes high the farther bar changes from red through pink to white. Movement toward the low side causes the nearer bar to change from white through pink to red. This system is illustrated in Fig. 3.

Mirror—This is the Navy system. On left side of the runway, it consists of a large concave mirror with five green lights on either side, forming a horizontal reference line. Six amber lights mounted in front at ground level produce an image on the mirror which, when reflected, appears as an amber ball to the approaching pilot. The amber ball, better known as "meatball," when aligned with green reference line, indicates on glide path. If meatball is above reference line, the aircraft is high and when below, the aircraft is likewise below. This is illustrated in Fig. 4.

Amber—This is the USAF system, located on the left side of the runway, consists of a cluster of amber lights bracketed by five green lights on either side which form a horizontal reference line. When the aircraft is on glide path, the cluster of amber lights, which appear as an amber ball, is horizontally aligned with the green reference line. When the aircraft is high, the amber ball is high, and when low, the amber is low. This system is illustrated in Fig. 5.

It is interesting to note that the Navy and Air Force systems are very much alike as to guidance presentation, whereas, the other 3 are different.

A National Standard does not yet exist for the Visual Glide Path Indicator and in all probability will not materialize until evaluation testing of all systems has been completed at FAA's NAFEC, Atlantic City, New Jersey. Navy pilots are encouraged and invited where possible to assist in this evaluation. ●

An FAA news release indicates that the British developed system of visual glide path indicator lights has been recommended by FAA's Bureau of Research and Development for adoption as a national standard for use at airports in the United States. The recommendation is being considered and final action is expected in about 30 days. The selection of the British Royal Aircraft Establishment (R.A.E.) system was made following the intensive evluation of five different types at FAA National Aviation Facilities Experimental Center.

For biography of CDR Gallagher please see page 10.

Fig. 4 **MIRROR SYSTEM**

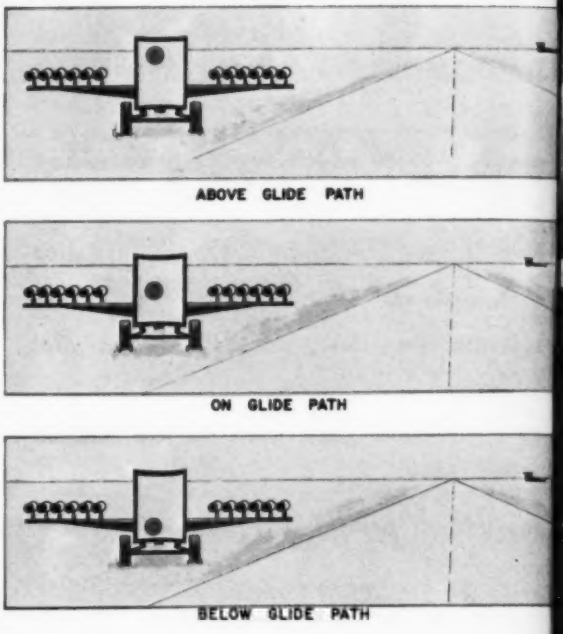
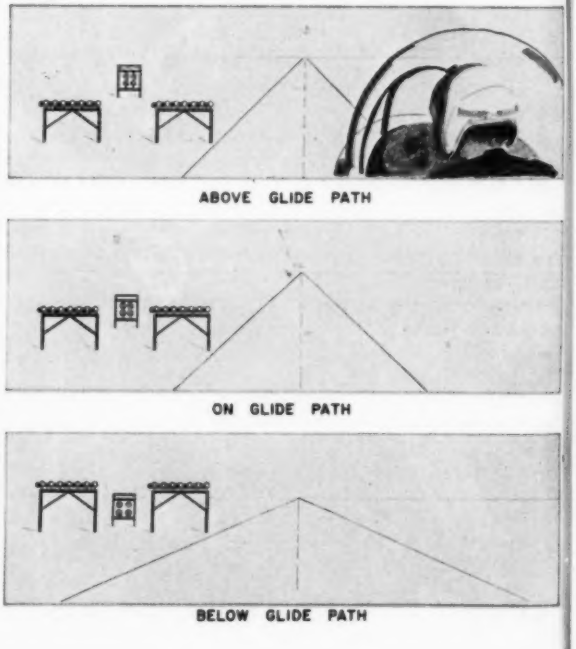


Fig. 5 **AMBER SYSTEM**



'Set Condition One'

THE storm did not take the station entirely by surprise: Radar tracked a curved line of strong echoes from as far out as 45 miles. The echoes, with tops reaching 35 thousand feet, were moving south toward the station at an estimated 25 to 30 knots. At 1930 in the evening, action was initiated to place the airfield in Thunderstorm Condition One.

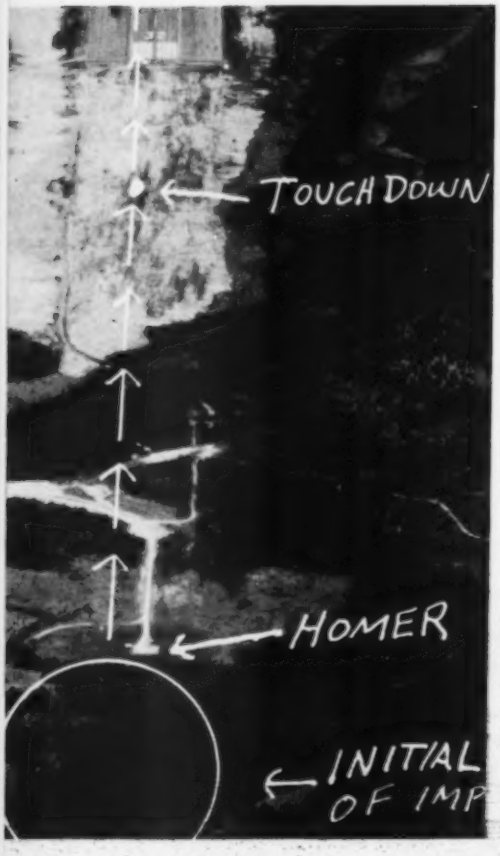
About 20 minutes later a jet called in from the south, estimating arrival over the station in 10 minutes. The pilot had been alerted to the line of thunderstorms by previous radio contacts and now he asked approach control a more specific question. "Do you have any severe weather within 30 or 40 miles of the station?"

Approach control answered, "There is severe weather 15 miles north, on an east-west line, moving south."

This was closer than the pilot had expected but the present terminal weather was enough to overcome his doubts; it was eight-thousand scattered, high broken. Visibility was 10 miles with a three-knot northwest wind. Maintaining his assigned 33,000 feet, the pilot bored on towards the field. He was now involved in a race against the thunderstorms but he was confident he could get to the air station first.

As the jet neared its destination, radar vectored and monitored the letdown. Upon rolling out of penetration turn the lights of the field came in sight at a range of about 15 miles. "I called and advised that I would discontinue the instrument letdown," the pilot said, "and would proceed direct to the field for an immediate landing due to the sinister looking thunderstorms to the northwest and north."

Sinister they looked and sin-



ister they were. Lightning rippled and flashed in a line all along the northern horizon. The radar observer partially lowered his APH-5 visor to avoid being blinded. For the same reason the pilot turned the cockpit lights full bright. Although the storm was still lying just to the north of the field, it had actually won the race.

The wind was veering to the north and increasing in gusts. The trap was about to snap shut on a classic textbook example of low-altitude flight in the vicinity of a thunderstorm.

Deciding against an overhead break the pilot asked for a straight-in. "I felt I would save two or two and a half minutes by this and at this time two minutes looked good." He checked five miles out as the tower requested, holding about 1200 feet above the ground. "I then commenced a landing cockpit check," he said, "slowed to 170 knots, dropped gear and only half flaps due to some turbulence. At three miles from the runway and at 800 feet indicated I was slowly letting down with 85 to 87 percent, holding 160 knots."

The trees on the south side of the field were now swaying and bending in the full blast of the storm's first gust; nearly 50 knots straight out of the north. Occasional fat raindrops were beginning to spatter on the runway. Immediately behind this skirmish line moved the wet blackness of the full storm.

GCA had been prepared to take the aircraft but as the pilot had skipped directly over to tower frequency the GCA operators had been unable to establish contact. Nevertheless, the final controller monitored the approach. It was lucky for the pilot that he did. Already at three miles out the jet was being pushed low on the glide slope.

Moving uneasily in gusty wind the jet was about two miles from the runway when, besides severe turbulence, the pilot felt a strong sinking sensation. The altimeter was bobbing on both sides of 500 feet and the radar observer recalled the rate of climb jumping all over the dial. "Shortly thereafter," the observer continued, "someone said over the radio, 'You are low, you had best pull it up,' or words to that effect."

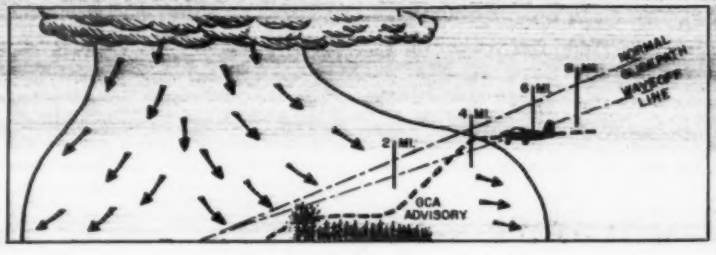
The pilot heard the call that he was falling low and without delay he responded with full throttle. Watching the approach on his radar scope, the GCA operator had seen the aircraft descending, at nearly a thousand feet a minute, and when it was well below glide slope he had, on his own initiative, called out the warning.

Without that warning it is probable the pilot would not have attempted to check his descent in time to avoid a serious crash. Any additional power would normally have caused the aircraft to climb but it was caught in the grip of the storm's downdraft and it struggled toward the runway just above the tree tops. The pilot had been concentrating on the approach and runway lights and though he knew he was low he apparently did not realize just how low until the lights ahead suddenly vanished.

All these events; the GCA warning, disappearing runway lights and the addition of power, occurred in quick succession. Had it not been for the storm the pilot might have seen the tall trees looming ahead. However his night vision was naturally impaired by the bright cockpit lights and lightning from the storm so the first knowledge of his position was an impact on the airframe and the sudden development of a large hole in the starboard canopy.

After that he said, "I secured

Flight path superimposed on cross-section of thunderstorm.



both engines and fuel switches, eased back on the stick and flew the aircraft down to the ground." Next morning an aerial search of the woods would show a trio of large pine trees with short haircuts.

Considering the state of the aircraft; collision damaged with flamed out engines, the radar observer's account of the remainder of the flight is almost anticlimatic. "We touched down smoothly in the overrun, coasted up to the runway and 6000 feet down it."

Circumstances leading to the accident were summed up by the accident board as follows: While in the final approach, the aircraft was flown into an area of excessive downdrafts and an accompanying wind shift of approximately 60 degrees and 30 knots. This was brought about by the leading edge of the thunderstorm in progress at the time of the accident.

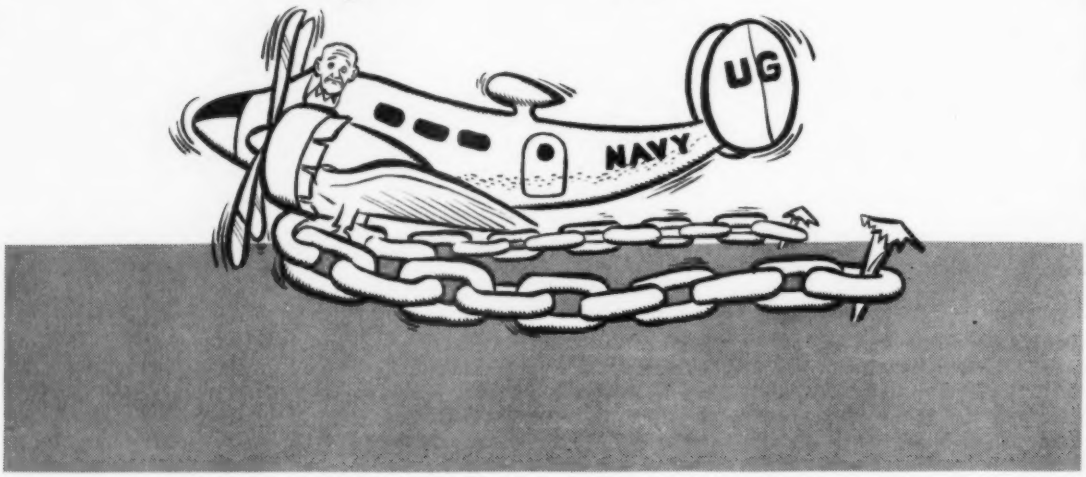
Before summing it up the board did considerable research into the low altitude effects of thunderstorm flying. One result was a reconstruction of the flight path which was superimposed on a vertical cross-section of a thunderstorm. It was noted with interest that the downdraft effects, with the appropriate distances involved, coincided exactly with the effects experienced by the pilot. From a distance of four miles the rate of descent was shallow for the first few hundred feet then accelerated rapidly as the full force of the downdraft was encountered. Further detailed information may be gained from "The Thunderstorm," NavAer SC-1R-241. A condensed version may be found in "Meteorology for Naval Aviators," NavAer 00-80U-24.

Before we move away from "ole flying sawmill" and the mechs busy picking splinters out of her aluminum hide, there is a question of what the pilot might have done to avert the accident. Based on the radio reports received his decision to make an approach was a reasonable one. Obviously the storm was closer than reported or moved faster than estimated—he had no way of knowing this.

Could the accident have been prevented by using GCA, which was set and ready for him? Very likely, the accident board believed. Under GCA control any sudden rate of descent would promptly have been announced with corrective action possible before a dangerous situation developed. The board also felt that if GCA were not used a normal break and circling approach would have been preferable and would not have delayed the landing appreciably. This may be controversial. If so, it is of interest to find that a second jet landed within minutes of the first.

This pilot, flying a TV-2, followed the same approach track as the first but at 2000 feet altitude, about 12 to 14 miles out, he could see heavy lightning and very low clouds in the vicinity of the field. When the thunderstorm was directly over the field the TV-2 was seven miles out on final. A GCA was broken off due to the disabled jet on the duty runway and the TV was vectored around to another runway on a surveillance approach. At this time the pilot reported being IFR in clouds, rain and turbulence. On ASR final, radar lost him in heavy rain squalls and as he was about to execute a missed approach he spotted the runway. At 500 feet altitude he made a 360 over the field and landed successfully in heavy rain, gusty winds and moderate turbulence. ●

Finally it happened— TO ME!



THIS report is of the type ("who could be so stupid") that I have read so many times. It only differs in that it happened to me. It is the standard situation: Six years Navy flying, proficiency billet, SNB aircraft, and a perfect night VFR flight *almost* completed.

Touchdown on landing was smooth but long. As I looked for the taxiway lights I became concerned about the aircraft I knew was behind me as I had not seen him go by on a waveoff. I decided to clear the runway to the right, knowing that all the area to the right was asphalt mat capable of holding the lowly *Beech*.

Immediately, to my surprise, I found myself straddling the arresting gear chain with one main mount. Rather than take a chance of some damage I called for assistance and held my position. The crash crew arrived shortly and after a survey of the situation, had me cut the engines while three big crash crew members pushed the airplane back over and clear of the chain. Since no damage had occurred I restarted the engines and requested taxi clearance to my line.

The fact that I had stumbled into the arresting gear should have alerted me to my position on the field but as you can see from the following it didn't.

The tower granted taxi clearance and I began to go back up the runway, that is in a direction 180 degrees from my landing heading. They also cautioned me to stay clear of runway 18 which was now the duty. I called again stressing I wished to taxi back up this runway and return to my line. The same clearance was received from the tower. "They sure must be working these tower people overtime," I thought to myself. Why would I taxi all the way down to 18 just to cross it? Runway 18 is behind me, and I am going *away* from it.

There was some difficulty seeing the lights, due to the bright lights which had been used by the crash crew and the dim set-

The purpose of Anymouse (anonymous) Reports is to help prevent or overcome dangerous situations. They are submitted by Naval and Marine Corps aviation personnel who have had hazardous or unsafe aviation experiences. As the name indicates these reports need not be signed. Forms for writing Anymouse Reports and mailing envelopes are available in ready-rooms and line shacks. All reports are considered for appropriate action.

— REPORT AN INCIDENT, PREVENT AN ACCIDENT —

ting on the field lights. My co-pilot was not too familiar with the field and I was concentrating on spotting the taxiway turnoff. Suddenly the blackness of the night was cut by the red rotating beacon and running lights of an S2F almost in the cockpit with me. I put on a burst of power and got clear of the runway while a frantic crash truck driver nimbly dodged both aircraft.

I now realized for the first time how long I had landed and the significance (distance-wise) of my trouble with the arresting gear. All the while I thought I was taxiing away from the intersecting runway I actually had been heading for it. The duty runway lights should have been turned up higher than other lights on the field. In this case, the off duty lights (presumably left on for my benefit) were actually at a higher intensity than those marking the duty. Even after I realized I had crossed the duty runway I still couldn't see it.

The tower must assume the pilot knows where he is but I have a suggestion which might clean out the cobwebs in the cockpit in a similar situation. Have the tower request "call before cross" instead of "caution, 18 is now the duty, do not cross." That might have awakened me to the fact that from my position I would have to *cross* one eight.

BREATHLESS TALE

IN ORDER to give the squadron air intelligence officer some fam with long-range low-level nav problems a flight with an AD-6 and an AD-5 was scheduled. The leader was fairly senior with plenty of hours in the Able Dog. This Anymouse is a Jay Gee with about 450 hours of AD time. We left the coast and the hop went as briefed until we started our return to home base. A solid wall of rain squalls and clouds was encountered over the mountains.

When it became evident that a VFR return was impossible, we retreated to El Centro which was CAVU to the moon. Home base was then reporting 1600 overcast and two miles visibility in rain so we started to climb on-top. By this time I had 800 pounds indicated on the fuel gage.

At 12 thousand I put on my oxygen mask while the flight leader started calling home base approach control. Here, I started having trouble keeping up and more power was added while nervously watching the fuel

gage. Then the passenger mentioned that he was not feeling well and wanted to know how to get his oxygen mask on and plugged in. This had not been briefed, but it will be the next time.

While trying to help the passenger, catch up to "lead" who was disappearing in and out of clouds, I was also trying to copy APC instructions. Approach control came up with a frequency finally but accomplished it with the mention that it would have to be a section approach due to traffic (must have been quite a few caught out in the rain I thought to myself).

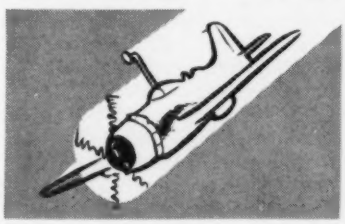
At last I caught up to "lead" at 17 thousand feet. To my surprise he did not have his oxygen mask on. Hummm, I thought again to myself. Considering my passenger's signs of hypoxia and fumbling for oxygen and the fact that a wingman is bound to the lead plane in a section approach —for better or for worse, I called approach control and told them I wanted an individual approach. My state was down to 500 pounds.

APC "rogered" the individual approach, advising of a possible delay, and cleared me to hold VFR on the radio beacon at 8000 feet.

At this time I broke away from "lead" and told APC I was holding VFR at 17 thousand. There followed a busy period of brief "gage watching" in scattered tops, reducing power to max economy and groping for the tacan holding point. After getting squared away, with numerous recoveries from unusual attitudes, I passed my lowering fuel state to APC. Happily, within a couple of minutes they came back with a frequency and said to come on down.

Lowering the speed brake, switching blowers, and *forgetting windshield* heat, I started the penetration 360-degree turn required to get to assigned altitude within the tacan mileage assigned. On final approach at 1000 feet, I looked up and saw—nothing! I did see the passenger pointing at the windscreen and then realized it was completely frosted over.

With a frantic swipe a small area was cleared and the approach lights were sighted almost immediately. Looking through the small hole I contin-



ued the approach in a driving rain.

Just prior to touchdown GCA advised that my divebrake on the belly was down (bless that outside observer). Speedbrake retraction and touchdown were practically simultaneous. Due to a 90-degree crosswind and wet runway I had one more moment of nervous anxiety fighting a swerve before I could consider that I was "safe at home." Taxiing to the line was uneventful and I was glad of it.

I had a gas chit packet so if I had wanted to avoid the whole thing I could have landed at El Centro. The flight leader had 350 more pounds of fuel so I should have made the approach first; I landed with 250 pounds indicated. The flight leader did not use oxygen because his mask mike was no good. In retrospect, we were ready for anything but trouble.

TOWARD ZERO

CLIMBING out of Memphis at night in an S2F we headed into known icing conditions which were PIREPed to be moderate. At our altitude of 7000 feet the airspeed started to drop. It went past ZERO to a large minus reading. A brief use of the flashlight around the outside surfaces was enough to reveal an iced up pitot tube.

Almost simultaneously I had snapped the pitot heater ON and in a few minutes (it seemed an hour) the airspeed bent back to ZERO, then slowly returned to 140 knots. No altitude was lost as the pilot eliminated airspeed from his scan and concentrated on the gyro horizon until conditions came back to normal.

It's not *easy* to forget pitot heat with rain or ice but it *can* be forgotten. *Please see "Pitot/Static System Water Removal," page 40 of June 1960* APPROACH.

HELPER?

AT DUSK an F8U that had just lifted from the field called in with an unsafe gear indication and requested a flyby for a visual gear check by the RDO. On the flyby the gear appeared to be down and in place and the F8U began an afterburner climb over the station to burn down to landing weight. At this time an Air National Guard F-84 called the tower with engine difficulty requesting a precautionary approach. When asked his position he reported "about 12 miles southeast at 12,000." The F8U was now in an afterburner climb over the station.

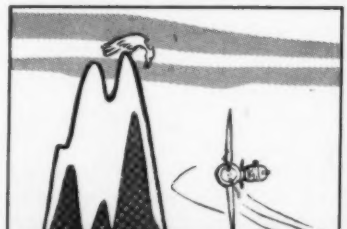
At this time the LSO on the field (who had been conducting FCLP) came up on primary frequency and broadcast "F-84 over Cecil, you have about 8 or 10 feet of flame coming out your tailpipe." The pilot of the F-84 replied "Me? on fire, roger, I'm going to leap out of this thing!" The tower then came up and advised the pilot of the F-84 that the aircraft over the field with the flame coming from his tailpipe was a *Crusader* in an afterburner climb. The pilot of the F-84 then decided not to eject and made a normal precautionary approach to landing. Both aircraft were in contact with the tower at all times during this incident, and it is my belief that there would have been no difficulty had the LSO let the tower handle this incident and not helped(?) the pilot having the trouble. The aircraft over the field was clearly visible to the tower as an F8U, not an F-84.

SIDE BY SIGHED

ON A cross-country instrument training hop I was instructor with the student in the left seat of an AD-5. There are no controls on my side so I am at the mercy of the student. We were heading for El Paso and though the weather was clear with 60 miles visibility we were filed IFR with the student under the hood.

After crossing ELP omni the student commenced an approach (El Paso radar had made positive identification of our aircraft) but he turned 45 degrees left of the outbound heading and after two or three minutes ELP wanted to know if we had an approach plate aboard.

In the meantime I had been trying to get the hooded student oriented in relation to the station and outbound heading without success. Radar gave us several steers to finally get us on the inbound radial. A circling approach was required, with right-hand pattern as the duty runway



was 180 degrees from the final instrument approach heading.

Upon leaving low station I had the student remove his hood. I asked him if he had the runway in sight and he assured me he did and knew exactly what to do. After crossing the field boundary he made a steep bank to the left, losing altitude all the while. Gear down too. He descended to 200 feet above the runway while all the time I am yelling "Power, Power, POWER!" "Level off!"

He paralleled the runway, still maintaining his 200 feet, not answering my repeated instructions to climb. Zip, the flaps went down to complete the checklist, then he turned base. He reduced power and we started to go down again. Again and still I am telling him to climb. After a very low and slow approach we landed—without doing any damage to anything.

In retrospect, I think the student became shook after his trouble with the omni approach. With Biggs AFB on one side, Mexico on the other, and the Franklin mountains straight ahead, a missed approach with a 180-degree turn and climbout was probably the best solution.

FOR 'ROUTINE'

THE pilot of the aircraft involved was launched from the aircraft carrier approximately 700 nautical miles from the San Diego area at 0637 on a Combat Air Patrol mission. He initiated a military rated thrust climb to 40,000 feet rendezvousing with his flight leader after reaching CAP station (075/80 NM from the carrier). At approximately 0710 the section was assigned a vector to intercept an incoming bogey. As the flight leader took up the initial vector, the pilot concerned dropped back into a 3-to-4-mile trail position. The flight then selected afterburner and commenced accelerating to 1.45 IMN.

After approximately 5 minutes of after burner operation, he selected military power and decelerated to .95 IMN. Shortly after stabilizing at .95 IMN, afterburner was selected and it failed to ignite. Two more attempts to light the afterburner were unsuccessful and he informed his flight leader of this fact. His fuel state at this time was 3300 lbs. Approximately 3 minutes later he noted his fuel

state to be 2200 lbs. falling rapidly.

He commenced an immediate idle descent to the ship from 30,000′ at 30 nautical miles. During the descent, the flight leader joined on him and informed him that vaporized fuel was streaming from the tailpipe. When at 3 miles from the ship, he noticed his low-level warning light illuminate (illuminates at 1200 plus or minus 100 lbs.). He dirtied the aircraft and commenced a mirror approach to the ship.

During the approach the power required to stay on the glide slope was higher than normal. The first pass resulted in a bolter because the hook was not down. The pilot then executed a second approach with a fuel state of 800 lbs. resulting in a successful arrested landing. Fuel state after arrested landing was 400 lbs. After clearing the arresting gear he secured the engine.

Immediately after securing the engine, a fire broke out in the tail section of the aircraft which was extinguished by the flight deck crew. The pilot stated after the incident that the waveoff characteristics were very poor and it was noted by maintenance personnel of the squadron that the afterburner eyelids were open when the aircraft crossed the deck on the waveoff.

In the opinion of several experienced pilots watching the incident, this pilot handled the situation in a very expert manner. As for the hook-up pass, I believe the ship and LSO should have taken care of this very important item for the pilot by reminding him of it on his way down the glideslope. This is the second recorded incident of this nature in the past two months, and although the Navy is getting to the bottom of this malfunction, it still leaves the pilot with a lack of information on what is happening to his airplane.

The professional approach to aviation is one of knowing exactly what to do in time of emergencies and of knowing your aircraft like you know the back of your hand. I think the F8U-2 Flight Manual is a good example of what I am driving at in that the emergency section leaves a lot to the imagination on the exact procedures to be followed in the case of an emergency.

A good example is the inflight fire procedures which indicate that the fire warning system in the bird is an overtemp warning device for the engine. I think that you will find after looking up the fire warning system in the aircraft, it is in fact a compartment overheat system. This is only one example of the misconception of the emergency section of the handbook. If the pilot has an exacting set of procedures to follow during an emergency, it no longer becomes an emergency, but a squadron practice and you can get the goofer to buy a round of drinks if and when he makes an honest mistake. ●

Have a problem, or a question?

Send it to

headmouse

he'll do his best to help.

Compass Know-How?

Sir:

My sympathies to the poor A3D drivers, complaining they can't even calibrate their compasses . . . , if they swallowed their pride and came to some of us old-fashioned many-fan squadrons, they might have found the answer to their problems.

Granted, it may be difficult to swing an A3D around a compass rose, even impossible when deployed aboard ship. But the problems are miniscule compared with trying to horse a P5M around a rose and get an accurate reading.

The answer, gentlemen, is simple, and guaranteed accurate, provided your B/N takes a few extra minutes planning. The periscopic sextant (which used to be standard nav equipment aboard the A3D) is useful for more than obtaining fixes, primarily, in this squadron, as a quick and reliable means for obtaining a deviation check. With about a half-hour's advance planning, sun and/or star lines can be pre-computed for four-minute intervals, and an air-swing can be accomplished in less than one-hour's flight time. This system has the added advantage of swinging the compasses while all necessary gear is in operation, and while the aircraft is in its normal flight attitude, criteria which are impossible to fulfill in a P5M on the deck. Secondly, the swing can be included as a portion of a routine flight, which obviates the necessity of sacrificing considerable aircraft availability time to the lengthy process of rose-swinging.

If VAH ASO, or any other persons with his type of problem, encounter any difficulty or wish any further information on this tactic, the Navigation Officer of any local patrol or VR squadron will be able to give out all the dope required.

I. J. RIMSON, LTJG
Ground Training Officer
VP-42

► Good dope on the 'how-to' of compass calibration. As to other reasons for non-compliance with directives it's likely these same outfits are unaware of Aircraft Instrument Bulletin 29-46, item 29 which requires compass compensation on each major check; MIL-C-7834 which spells out the general requirements governing the swinging of compasses in aircraft for compensation and calibration and TO 05-15-3 (AF TO 5N-1-1) which states "Aircraft compass swing compensation will be accomplished when known deviations are in excess of tolerances, after replacement of compass system components, at the time a change of engine or other equipment likely to affect the magnetic field is made, and at periodic inspections applicable to the aircraft."

The fact that Handbook of Inspection Requirements for the A3D and other models do not call for compass calibrations at these intervals and that the foregoing directives bear somewhat ancient dates, may also be reasons for non-calibration of compasses.

Very resp'y,
HEADMOUSE

A4D Murphy Alert

Dear Headmouse:

Statement of problem: The radar and AFCS control boxes are next to each other on the A4D console. One of the plugs on the AFCS controller is identical with one on the radar controller. There have been several reports of these plugs being interchanged. When the radar cable is connected into the AFCS controller 115 volts are applied between pins "C" and "D." This high voltage will burn the winding in the pre-set heading syncro. With the AFCS cable connected to the radar controller, there will be no aileron trim. This also connects a short circuit to two phases of the 26-volt aileron trim transformer. This circuit is completed via the de-energized contacts on relay K-3 in the radar controller (connected to pins "S" and "T").

It is clear that any modification to the equipment which would correct all the difficulties caused by interchanging these plugs would require extensive rewiring to both of the controllers and the aircraft. It is the opinion of the writer that the plugs should be replaced or rekeyed on one controller so that interchanging of plugs would be impossible. As a temporary fix, it is suggested that the connector on the radar cable be painted a bright *red* and wide distribution made of this information.

The writer has also noted that a number of the connector cables on the AJB-3 Compass adapter can be misconnected. The flux valve connector cable may be inserted into a number of different and incorrect circuits and plug/circuit configurations are possible.

Generally the compass adapter is changed with the jet engine installed. The area is a very difficult one to work in, and a flashlight must be utilized. The difficulty in installing the compass adapter connectors increases the probability of their being misconnected. We are not aware of any component failure which would result from misconnecting this equipment, but feel that it is not desirable and could have been avoided at the design stage.

Ref: NavAer 01-40AVB-2-10 fig 10-33 Aileron Trim; AFCS Roll Signal Chain part 11 (page ten of 15) page 11-27.190 Drawing 7664173 Douglas Aircraft Wiring Book; NavAer 01-40AVB-2-11 fig 1115 AFCS Control panel, plug 12J1 Pins "V" & "D" Black and Red leads; NavAer 01-40-AVB-2-8 page 159 Radar Control panel.

ANYMOUSE

► The problem as stated has been verified. Difficulties related to this equipment may well have stemmed from the Murphy's Law situation you describe. Accordingly NASC alerted operating commands by safety-of-flight message and has requested an appropriate fix from BuWeps. If our Anymouse reporter will identify himself Headmouse will send him a 6-month supply of the finest imported cheese.

Very resp'y,
HEADMOUSE

Approach Minimums

Dear Headmouse:

There is a possible ambiguity in OpNav Instructions which creates a "haze" that you might penetrate for me:

OpNavInst 3721.1C states that, when making a radar approach under instrument conditions, pilots of single-piloted aircraft will level off when the facility's ceiling minimum has been reached, but *no lower than the ceiling minimums* authorized in OpNavInst 3720.2A unless the landing area is in sight.

OpNavInst 3720.2A contains weather criteria for the *approving* of IFR flight *plans*. It does not contain a statement which can be construed to mean that these minimums are to be used for anything but clearing purposes.

As an example, let's assume that NAS R02N has PAR published minimums of 100-¼. According to 3720.2A, a single-piloted aircraft may not file for this base if the weather is less than 200-½. On arrival at NAS R02N, may the pilot commence an approach if the weather is between 100-¼ and 200-½? Also, may the pilot of a single-piloted aircraft commence a Tacan (or other similar) approach if the weather is below the "filing" minimums but not below the facility minimums?

O. G. MCDONALD, CAPT, USMC
NAAS Kingsville, Texas

► There's really no ambiguity although the haze you encounter is a recognized occupational hazard among all pilots who try hard to abide by the rules. The minimums in 3720.2A are indeed clearance minimums and, according to 3721.1C, " . . . *are predicated on pilot/aircraft limitations and are solely the pilot's responsibility to observe.*" Once you're in the air, the published minimums normally apply. *But* —3721.1C has taken those clearance minimums and made them applicable to single-pilot aircraft for honest-to-goodness radar (PAR or ASR) approaches as well, that's all.

Yes, you can *commence* a PAR approach at NAS R02N, because the field is above published minimums (see 3720.2A, Sec. III-2.b.)—but 3721.1C says you'll have to level off at 200 feet if you don't have the runway in sight. The Manual of Radar Air Traffic Control Procedures, OpNav Inst 3722.17A, says, " . . . *a radar approach may be given to any pilot upon request, regardless of weather conditions . . .* " but, " . . . *the pilot is responsible for determining whether the approach and landing are authorized under the existing weather minimums . . .* "

"Say again, all after ATC clears."

You can commence a Tacan, or an Omni, ADF, ASR or LF range approach too, as long as the field is above its published minimums for that type approach. *But*—for an ASR approach 3721.1C steps in again and says you must level off *no lower than the ceiling minimums authorized in 3720.2A*, and that's 200 feet above the published ASR minimums.

Very resp'y,
HEADMOUSE

Functional Checks

Dear Headmouse:

In the June 1960 APPROACH there was an article by J. M. Smith, FUR Analyst of NATSF. A caption on one of the pictures used with the article referenced Aircraft Instrument Bul. 24-46. It was implied the bulletin required a functional check of the "static" system after completion of maintenance work. This bulletin is a long time cancelled; however, the idea is a good one. It may be that reference to AIB 29–46 was intended. If this is the case, we are up a tree, since this one doesn't specifically require the check. Please give this a check and let me know the outcome.

WILLIAM R. MATTIX, AMCM
NATTC, Memphis

► The photo and caption were added to author Smith's article. You are correct—AIB 29-46 was intended and we regret the typographical error. AIB 29-46 provides guidelines in the formulation of detailed instrument checklists to be used in conjunction with routine aircraft checks and is adaptable to local conditions. The Handbook of Inspection Requirements (HIR) states "good maintenance practice dictates that aircraft coming out of scheduled or non-scheduled maintenance have operational tests performed on the effected equipments and/or systems to ensure proper functioning prior to returning the aircraft to an 'up' status."

Very resp'y,
HEADMOUSE

SERVICING T

AS THE F4H development program progresses, more Phantom Twos *will be making transient stops at strange fields. In this situation, where personnel are not familiar with this complex multi-million dollar aircraft and handbooks are not available, a set of simplified servicing procedures would be a big help in getting the airplane on its way again.*

THE F4H

Here, therefore, are the main points; these procedures are the quickest and simplest possible. They can be accomplished without the use of external electric or hydraulic power. Therefore, they should be very useful at a transient stop, where experienced crews and special servicing equipment are not available. The pilot must still bear the responsibility for proper preflight checkout of the systems; but these instructions will enable a crew unfamiliar with the F4H to service the fuel, hydraulic, oil, pneumatic, and oxygen systems. *These procedures do not replace the Flight Manual procedures for normal operation and servicing at home base.*

General Information

The F4H has no battery. All electric power must come either from the aircraft generators while the engines are running, or from an external power cart if the engines are shut down. This must be kept in mind, because with engines shut down and no external power applied, the switches that control the various fuel, hydraulic, and pneumatic functions *have no effect.* The electrical system of the F4H is relatively complex, and should only be operated by qualified maintenance personnel or pilots who are familiar with the Manual procedures. It is for this reason, as well as for convenience, that the following procedures for basic servicing do not involve the application of external electrical power to the aircraft.

Preparation

In order to use these procedures the airplane must be prepared for servicing before shutting down the engines. This can be done entirely within the cockpit, without signaling crewmen to position external switches. The flaps and speed brakes must be UP and controls NEUTRAL. The in flight fueling control switch in the cockpit must be in REFUEL, and the refuel selector switch in ALL TANKS. In aircraft BuNo 146817 and up, placing the gear handle DOWN before landing will have the same effect as placing the fueling control switch in REFUEL. The wing fuel dump switch must be in NORMAL. The wings may be either folded or spread. During engine shutdown, wait until the generators drop off the line before turning off the engine master switches. *Note*—This applies to Ship No. 19 (BuNo 146817) and up. It also applies to earlier aircraft *if* the fuel control relay panel has been rewired.

Refueling

Caution—It is most important that the wing fuel dump switch in the cockpit be placed in NORMAL prior to engine shutdown. If it was left in dump position, large quantities of fuel will pour out on the deck when pressure fueling starts. Turning the switch off then will have no effect until external power is applied to close the valve.

Connect the pressure fueling nozzle to the inlet valve, inside Door 26R, on the right-hand underside of the fuselage just under the aft cockpit. Proceed to refuel. The float valves will shut off flow to each tank when it is full.

Oil Servicing

The oil filler, vent, and drain parts are inside Doors 81 right and left, which are on the underside of the fuselage about halfway back. The oil must be pumped in, preferably using a General Equipment Company 36-100 oil servicing cart. If this is not available, a hand pump can be improvised. An Essex No. 277000-1-4 double disconnect is necessary to attach the oil source to the filler part; this fitting is not universally available, and so pilots should carry one when they are expecting to make a transient stop.

There is no oil level indication; oil should be pumped in until it comes out the overflow vent. Use Mil-O-7808 oil only.

Oxygen Servicing

The oxygen filler valve is inside Door 17, which is on the underside of the fuselage just aft of the nose gear well. The filler port takes a standard fitting. Place the lever of the build-up and vent valve to VENT. Then fill until liquid oxygen flows

out the vent. Then place the handle of the build-up and vent valve to BUILD-UP. Warning—Liquid oxygen must be handled only by qualified personnel, wearing protective clothing.

Servicing may not be necessary at all; if there is five liters or more remaining, that is plenty for a two-man crew on a normal flight. Three liters is enough for one man.

Air Compressor

Open Door 28L on the underside of the fuselage to check the oil level in the air compressor sight gage.

Hydraulic

Proper servicing of the hydraulic reservoirs and accumulators is very important. There are three independent systems in the F4H: two power control systems and a utility system. The reservoirs are of the airless type, and are pressure-filled from remote filler ports. The filling pressure must not exceed 75 psi. Use Mil-H-5606 only. To mate with the aircraft filler ports, the hose from the filling source must have an Aeroquip coupling, composed of Part No. 155-25-5D and T150-S1-4D coupling halves. This coupling will screw into a standard end fitting. When not in use it should be protected by an Aeroquip 155-S9-5 cap. As with the oil filler coupling, this Aeroquip coupling is not commonly available and so the pilot should carry one if he expects a transient stop.

Servicing Power Control System No. 1

First bleed any air in the reservoir by means of the bleed valve in the left main gear wheel well. Then bleed the reservoir sub-system pressure, by means of the manual bleed valve plunger in the left main gear wheel well. Then air-charge the system accumulator, also in the left main gear wheel well, to 1000 50 psi. Charge the reservoir sub-system accumulator to 2000 50 psi. This is located in the left main gear wheel well. Check the reservoir fluid level in the indicator, visible through Door 76L, which is just forward of the left main gear wheel well. If it is below the FULL-ZERO PRESSURE mark connect a pressure filling source to the filler port in the left main gear wheel well, using the Aeroquip disconnect specified above. Pump in fluid until the indicator reads FULL-ZERO PRESSURE. Do not use a filling pressure greater than 75 psi.

Servicing Power Control System No. 2

The procedure is the same for System No. 1, except that there is no sub-system to bleed, and no reservoir accumulator to charge. The reservoir bleed valve and filler port, and the system accumulator are in the right main gear wheel well. The reservoir level indicator is inside Door 76R, just forward of the right wheel well.

Servicing The Utility System

The procedure is the same as that for Power Control System No. 2, except that the brake accumulator, in the nose wheel well, must be charged to 1500 50 psi. The main system accumulator and the reservoir air bleed and filler fittings are inside Door 23, aft of the nose wheel well.

Pneumatic Servicing

Note: This can be done without electrical power only if the pneumatic piping has been modified. In the first 23 F4H airplanes, BuNo 142259 through BuNo 146821, external electrical power must be connected in order to ground charge the pneumatic system. This is because the blowdown valve on the moisture separator is open when its solenoid is de-energized. The air thus goes from the ground charge valve to the moisture separator and then over the side through the blow-down valve.—Since it is often inconvenient to obtain an electrical part, some of these early aircraft have been modified to eliminate this necessity. The change is simple, consisting of removing one tube on the pneumatic door (22), adding one short tube, and replacing one fitting. This puts the incoming air into the system downstream of the moisture separator.

Pressurize the basic pneumatic system to 3000 psi through the charge valve inside Door 28R, which is on the underside of the fuselage about even with the leading edge of the wing. The connection is standard. Observe the pressure on the gage inside the same door (28R), since the cockpit gage will be inoperative with no electrical power.

Charge the arresting gear dashpot through Door 58 on the right side of the fuselage at the base of the fin. Use the pressure indicated on the chart inside the door.

Charge the nose gear shimmy damper according to the name plate.—*McDonnell Aircraft Corp. "Field Service News"* ●

"Agility of mind, skill with the hands, pride of accomplishment, devotion to duty. These are typical of our maintenance people. They have the inherent ability to do their jobs. All they need is adequate instruction, proper tools and incentive."—USAF

BACKFIRING

. . . in the reciprocating engine is a symptom telling of abnormal operating conditions requiring immediate action

By

M. J. Bourgeois, Jr.

Reprinted from USAF *"Maintenance Review"*

MOST pilots and maintenance crews have experienced some form of engine backfiring, whether of the noisy kind or signaled by vibration. Backfiring is simply defined as lean mixture seeking the missing element—fuel—which is available at some source in the induction system from the combustion chamber backward to the carburetor deck screen. This definition is clearly the opposite of after-firing, which conversely is defined

Sump plug shows internal damage to engine resulting from force of backfire.

as a rich mixture seeking the missing element—air—and then firing.

How is Backfiring Recognized?

Problematically the sound produced by each of these incidents may be similar and either can cause vibration. However, a sudden drop in torque pressure, coupled with an increase in manifold pressure and carburetor air temperature, is a positive indication of backfiring.

Is Backfiring a Primary Cause?

Backfiring is a symptom of engine malfunction —not the cause. A review of engine histories and reports of backfiring reveals that, and this usually after the first backfire, sufficient damage had been done to the working parts of the engine to cause immediate failure or failure in a minimum of time. Obviously, recognition of backfiring is a most important point. Any history of backfiring on an engine is a clear warning that the engine is stealthily but steadily being robbed of its power-producing capability. The velocity of the explosion (backfire) is actually unmeasurable. It has been proved to be sufficiently severe to blow intake valves open on the wrong stroke, bending or breaking them when they strike the piston.

What Causes Backfiring?

Preignition is very closely associated with and generally causes backfires. This relationship is clearly evident when the specific causes of backfiring are discussed. Any condition which allows combustion at the wrong time in relation to intake valve position creates a condition susceptible to backfire. Such mechanical conditions as improperly adjusted valves, improper ignition and incorrectly adjusted idle mixture lead to backfiring. Material failures in valves, valve seats, rocker arms, push rods and other induction system related components contribute to backfiring.

What Are The Effects of Backfiring?

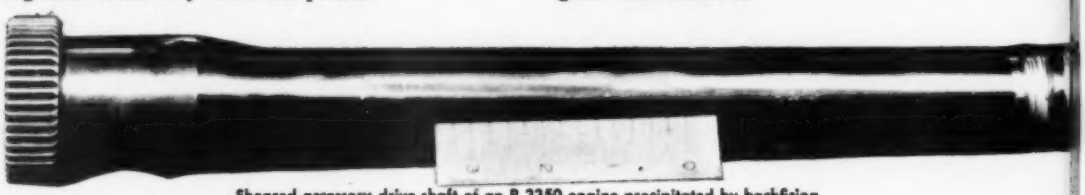
The harmful effects of backfiring are many in number, aside from the obvious immediate loss of power. Any induction system component may be physically damaged by a backfire. Further, other internal engine parts such as accessory gears, rods, bearings and propeller shafts may be cracked or otherwise damaged due to the force of the backfire. *Also, dislodged carbon particles can enter the lubrication system and clog the oil strainer or restrict oil passages precipitating and engine failure.—Ed.*

What Must Be Remembered About Backfiring?

We may assume from this discussion that correcting the specific cause of a backfire on an engine is not enough; the maintenance man must also thoroughly inspect for and repair damage resulting from the backfire. An engine which has experienced backfirings should be subjected to an inspection equivalent to a periodic inspection and the appropriate steps of engine conditioning completed prior to release for further flight.

How Serious Is Backfiring?

The seriousness of backfiring cannot be overstressed. Pending revisions to Flight Operational Handbooks will provide necessary instructions stressing Flight Safety implications. It is up to the maintenance man to eliminate the results of backfiring and to minimize material failure and system malfunction which could cause an accident. It's up to the flight crew to advise the maintenance man whenever backfiring—symptom of a sick engine—has occurred.



Sheared accessory drive shaft of an R 3350 engine precipitated by backfiring

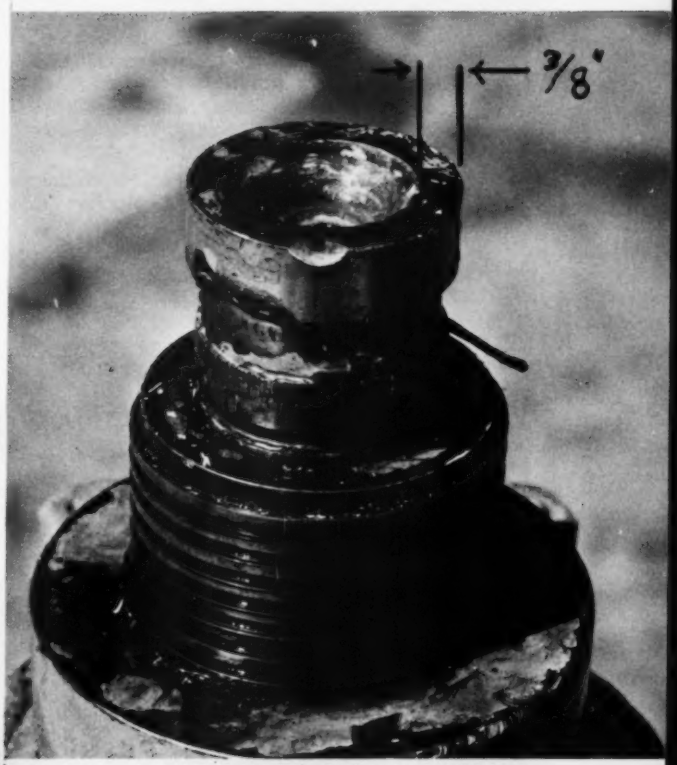
NOTES AND COMMENTS ON MAINTENANCE

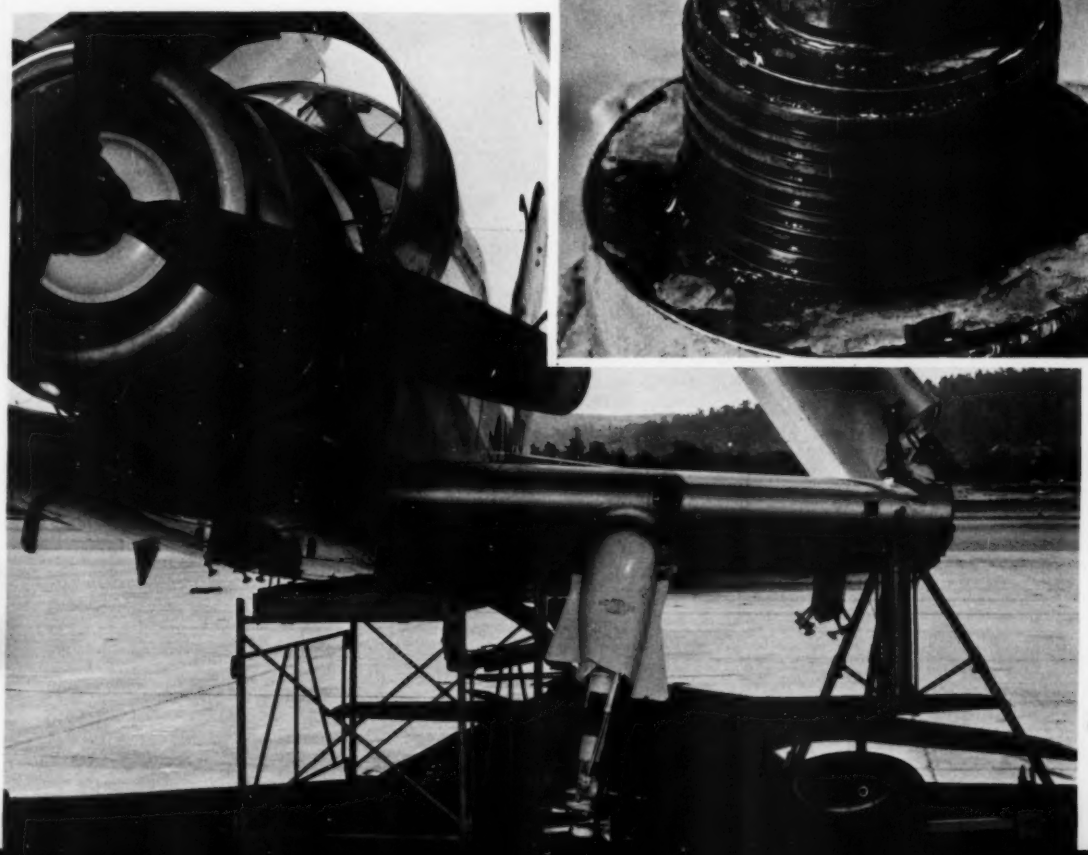
SLIPPING JACKS

This AD had been jacked up in order to drop-check the landing gear and to change wheel bearings. Gear was down and locked with the left wheel removed. Ninety minutes after being placed on the jacks, the left jack pad slipped off the left jack allowing the aircraft to fall on the jack. The jack penetrated the lower and upper surface of the left inboard wing section and the upper surface of the folded outboard section (see photo below). One man, who was working on the engine, received a minor head laceration.

There are two possible causes of the accident:

Damage and marks on the rim of the jack socket (see photo at right), and the results of





several post-accident jacking trials indicate that the jack pad (ball-shaped) could have been placed on the wide rim (⅜") of the jack socket instead of the center of the jack socket.

The aircraft was jacked on an uneven surface. During the jacking process an excessive undetermined lateral force may have developed, working the pad out of the jack socket.

It was recommended that only narrow-rimmed jack sockets be used for jacking operations. The squadron concerned has received approval to machine jack sockets to a depth of ¾" to provide a deeper socket to prevent the jack pad from steadily moving or slipping out of the socket in the event of unusual lateral force. Jack sockets to receive wing jackpads are normally ½" deep.

It was also recommended that:

► only narrow-rimmed jack sockets be used for jacking operations with smooth jacking surfaces be designated.

► aircraft be tied down after they are placed on jacks outdoors, otherwise conduct all wing jacking operations within a hangar. Note: The HMI specifies that if tie-downs are used they should be slack when the plane is on jacks to prevent tearing out the tie-down fittings in the event the plane slipped off the jacks.

PLANE DIRECTORS, NOTE—"This is the third crunch of this squadron's aircraft in three weeks. In each case, it involved ground handling personnel. Admittedly, things are a bit crowded in hangar bay three most of the time, but this should not be an excuse for having an accident; it should be a reason for exercising more care and caution in movement of aircraft in tight places.

"In this case, the director was concentrating on keeping the wings clear of obstructions while the F3H was moved forward. He failed to notice that, as the aircraft moved forward in the bay, the vertical stabilizer was coming closer to the stabilizer of the Ready A3D, which was parked near the No. 3 elevator.

"It is recommended that whenever possible, a safety man be stationed near the tails of aircraft that are being pushed tail-first in areas where aircraft are packed close together. It is further recommended that all plane directors continue to be drilled in the safe handling procedures of aircraft. If the director cannot survey all possible points of contact on aircraft being moved, he should stop aircraft movement until it has been definitely determined that safe progress can be resumed.

"This mishap is another example of the unfortunate fact that some aircraft movements because of crowded conditions and the pressure of operations, demand the presence of extra personnel for safe execution. Too often, after an aircraft handling crew is well trained, they undertake tasks beyond their numerical capability."—*From a Ground Accident Report*

FINE LINE—During a night inspection tour of the line, a vehicle was driven into the trailing edge of the port wing tip of an FJ-4.

Causes contributing to this accident all may be summarized by the phrase: "The driver did not see the aircraft." His speed was excessive. His approach to the aircraft from the rear gave him a knife-edge view of the aircraft, and he was operating his truck closer to the parked aircraft than is considered safe.

A fine line is most difficult to distinguish at eye level in the daylight, and is next to impossible at night. When approaching the FJ wing from the trailing edge, the eye target presented is a fine line.

Darkness, and the presence of distracting white

Knife-edge of wing is almost impossible to see at night.

lights not too far distant from the scene of this accident, may have tended to spoil the concentration of the security guard.

Such conditions may easily be repeated, and since the area to be inspected is relatively small, it is believed that recurrence of this type accident may be prevented by the adoption of measures to assure that the area is inspected on foot, and that vehicles are excluded from the area at night.

MAYHEM IN THE TIRE SHOP—HAP + BJ = BANG! High air pressure combined with bad judgment invariably results in a wheel or tire explosion.

The latest in a series of tire and wheel explosions involved the removal of a still inflated tire from an aircraft wheel which required a longer than normal tube stem and double valve core. Removing the first valve core did not relieve the air pressure in the tire consequently the wheel separated violently when disassembled and seriously injured a shop man. Actually, the above incident is typical of a growing number of tire shop mishaps. Listed below are discrepancies in procedure and malpractices frequently found in accident reports and also as a result of a survey of several tire shops.

- ► Failure to clean and inspect wheels for cracks and other defects.
- ► Failure to assemble wheel sections properly
- ► Failure to employ proper torque values or use proper torquing procedures.
- ► Failure to employ proper sequence order while torquing down wheel sections.
- ► Use of high pressure air in lieu of regulated low air pressure.
- ► Substitution of incorrect wheel retaining bolts, studs, nuts.
- ► Reuse of overstressed wheel hardware.

What is going on in these shops? Where are the supervisors? Would you not agree that the relatively high number of accidents and injuries occurring in tire shops, or as a result of malpractices in the shop, suggests added command attention and departmental supervision are needed?

ELBOW ROOM—"This mishap is another example of an accident that occurs with alarming frequency. In this case, the plane director failed to allow sufficient clearance for the tail of the F3H to pass clear of the nose of the F11F. When an aircraft is being towed in a turn, the outermost parts of the aircraft will move at a faster rate than the towed speed of the aircraft. Had the director anticipated this, he undoubtedly would have ascertained that the clearance was sufficient.

"Ground handling personnel must be made to realize that by moving aircraft under their control in a safe and cautious manner, they will be contributing their share towards the air defense and combat capability of the ship. Conversely, careless or inattentive performance results in 'Crunches' which often seriously impair the effectiveness of the ship as a fighting unit.

"In the air, an aircraft is capable of withstanding many times the force of gravity, but can be easily damaged when on the ground. It is therefore of the utmost importance that ground handling personnel exercise good judgment and due caution in the performance of their duties." *—From a Ground Accident Report*

NON-USE OF O-RING RESULTS IN USE OF D-RING—The Disassembly and Inspection Report for a J65-W16 engine involved in a recent aircraft accident revealed the following discrepancies. The engine driven fuel pump inlet and fuel by-pass fittings were installed with shipping gaskets in lieu of the prescribed O-ring seals, 123976. Although this was not considered to be a contributing factor to this accident it was noted that it constituted a definite fire hazard. These fittings under certain operating conditions, are subjected to relatively high fuel pressures. Therefore the need for more than routine sealing capabilities is apparent.

The systems associated with the J65 and all modern engine and aircraft combinations are designed to preclude the most minute leak. The pressures involved in these systems are such that, if system integrity is not maintained, atomization of leaking fluids in areas of relatively high temperatures substantially increase the possibility of fire.

Nonremoval of shipping gaskets and the improper selection of seals and gaskets continue to add to the maintenance work load. In addition, the increased hazards of both fire and system malfunction that evolve from improper seal installation reemphasize the necessity for system integrity.

To preclude recurrence of the shipping gasket being used for operating purposes it is recommended that shipping gaskets, blocks and caps installed on fuel pumps TG 77200-4 be tagged for removal prior to installation. In addition, it is recommended that the appropriate seal for each part be attached in close proximity in a hermetically sealed envelope.

Maintenance and quality control personnel must

assure that the correct sealing agent is selected. Pertinent technical publications should be consulted to assure selection of the proper seal prior to installation.

IMPROPER TORQUING AND LOCK-WIRING—Recently, while preparing for an emergency carrier landing due to a zero oil pressure reading, the pilot of an A4D jettisoned his drop tanks which struck another A4D flying wing position causing overhaul damage to the aircraft. Fortunately both aircraft were landed successfully.

The cause of the zero oil pressure—the oil pressure pump strainer cap, 227257, had backed off ⅛ of a turn due to improper lock-wiring. This condition permitted oil to be lost. The engine was rejected to overhaul.

Major factors contributing to this incident were improper torquing and lock-wiring, and poor quality control. The J65 Handbook of Service Instructions (AN02B-35AAC-2) page 45, paragraph 2-86 under the heading "Oil Pump Strainer Cleaning" very clearly describes the proper strainer and cap installation. The "CAUTION" note is quoted "Center the sealing washer while installing the cap; use extreme care when tightening the strainer cap; torque the cap to 80-90 inch-pounds and lockwire."

Maintenance personnel must adhere to the published torque limits and to approved maintenance procedures. To do otherwise is to invite trouble and possible fatal injury.

FUEL CELL FAILURE—A recent Safety AmpFUR telling of serious fuel cell deterioration in F9F aircraft reemphasizes the need for continuing inspections for this condition in *all* aircraft with self-sealing rubber fuel cells. Daily and preflight fuel samplings from drain cocks; periodic inspections and samplings from airframe fuel filters; and meticulous internal inspection of fuel cells on major checks will all reveal impending failure.

Fuel samplings should be collected from the drain cocks into clean glass containers and inspected for particles of rubber or sealant. When such particles are found inspect the fuel cells *internally* for ruptures, cracks, blisters or other signs of deterioration in accordance with applicable handbook instructions and the requirements of NavAer 03-10-513. All activities must insure rigid compliance with these inspections in order to avoid the serious consequences which attend fuel cell failure.

FOD

FOD-PROOFING—Current F3H/J-71 FOD rates in NavAirPac indicate that this problem is not receiving deserved attention. Perhaps some squadrons are considering FOD in the same category as death and taxes. Here is proof that FOD is not inevitable: VF-193 adopted the attitude that all F3H/J-71 FOD can be prevented by careful maintenance practice. The squadron then attained a record for NavAirPac *Demon* squadrons by remaining FOD-free for more than nine consecutive months, shattering the previous record of five months. Based on NavAirPac averages, VF-193 thus saved about three engine changes and approximately $48,000 in overhaul costs, not to mention the resulting improvement in flight safety. This kind of attention to detail in maintenance has been rewarded by CNO safety awards in 1956, 1958, and 1959 and the squadron is a top competitor for the 1960 award.

TEMPTING FOD—A thermometer used to obtain outside air temperature was inadvertently left on the inside of the nacelle of the starboard engine of an A3D-2. The engine was then started and the thermometer was ingested in the engine.

The N-1 compressor was damaged. Mercury and glass ingested and other pieces were found in bleed valves. The engine was removed for change of N-1 compressor, and shipped to O&R because of possible damage by mercury internally.

This incident was plain and simple thoughtlessness; however, the following may have contributed:

Engine trim was being performed by "Nite Check" who had been on duty for (11.5 hrs).

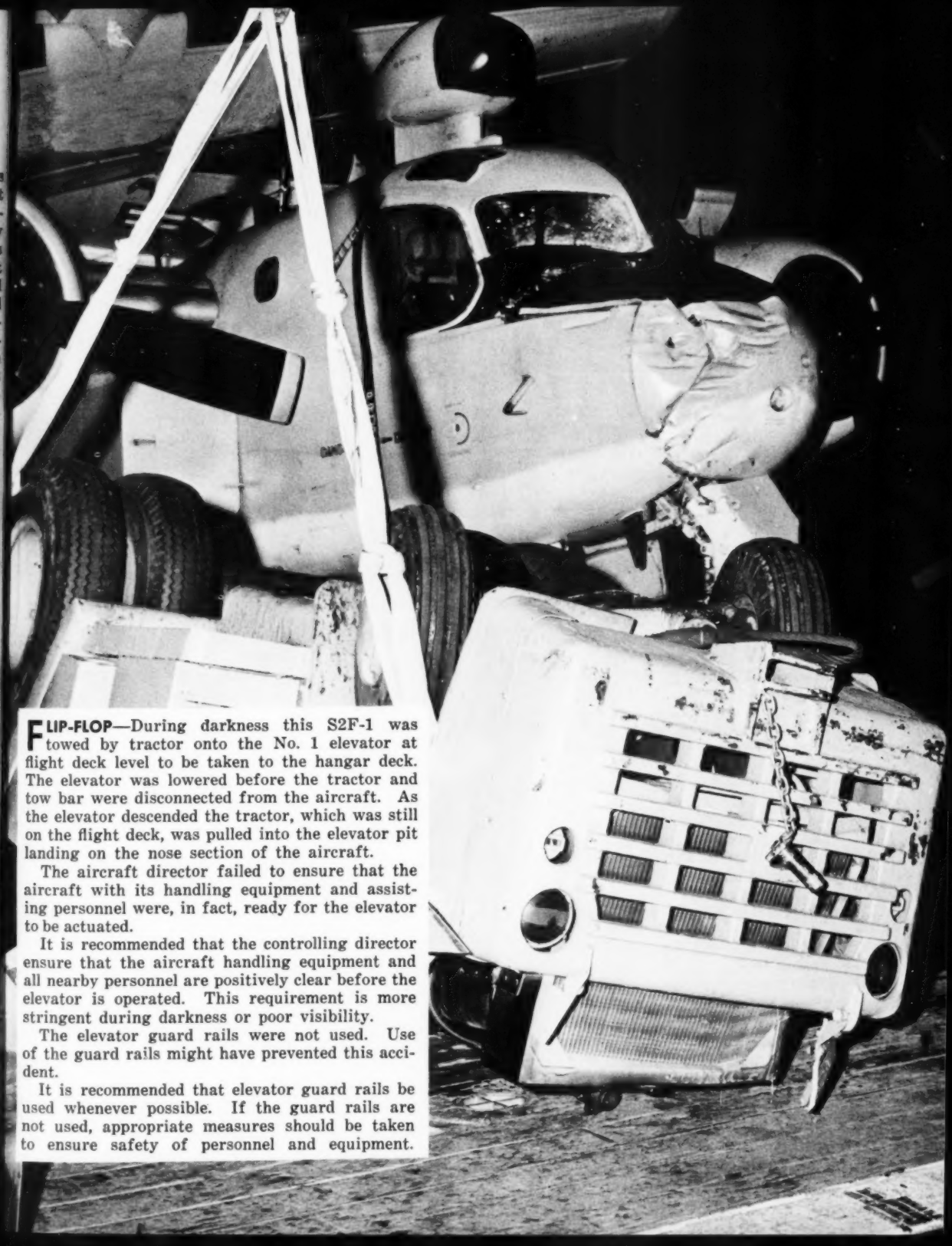
Crew just completed a fuel CG Valve change (fumes).

The desire of Nite Check to get aircraft in up status is commendable; however, fatigue may very well be a factor in this case. Normal squadron procedure is to hand hold thermometer in front of intake, record reading and replace in tool box. Inlet air screens are not used due to poor effect on trim curves.

The Accident Board recommended:

► Eliminate use of thermometer in vicinity of aircraft altogether. Air temp. can be readily attained anywhere outside of hangar.

► Supervisory personnel involved be cautioned of potential hazard of fatigue during long working hours in close quarters and possible presence of fuel fumes and effect on working personnel.



FLIP-FLOP—During darkness this S2F-1 was towed by tractor onto the No. 1 elevator at flight deck level to be taken to the hangar deck. The elevator was lowered before the tractor and tow bar were disconnected from the aircraft. As the elevator descended the tractor, which was still on the flight deck, was pulled into the elevator pit landing on the nose section of the aircraft.

The aircraft director failed to ensure that the aircraft with its handling equipment and assisting personnel were, in fact, ready for the elevator to be actuated.

It is recommended that the controlling director ensure that the aircraft handling equipment and all nearby personnel are positively clear before the elevator is operated. This requirement is more stringent during darkness or poor visibility.

The elevator guard rails were not used. Use of the guard rails might have prevented this accident.

It is recommended that elevator guard rails be used whenever possible. If the guard rails are not used, appropriate measures should be taken to ensure safety of personnel and equipment.

Inspection Aims

Following are two expressions of opinion on the subject of Inspection. One, "Objective of Inspection," reflects the military and is quoted from a recent issue of SAC Maintenance & Engineering Bulletin; the other, "Real Aim of Inspection," is quoted from a talk given at the recent FSF Business Aircraft Safety Seminar, by Paul C. Griep, Chief Engineer, General Motors Air Transport Section. Both are invitations to thinking.

Objective of Inspection

"From time to time there is an apparent misconception of the objectives of inspection. Some individuals believe that the inspector's mission is to check the degree of compliance, or non-compliance, with policies and directives.

"It is pointed out that inspection does not consist solely of checking for compliance with directives. Inspection has the overall objective of determining where improvement is needed, locating the causes of unsatisfactory conditions, and following up to assure improvement or adequate correction.

"Normally, an inspector should not have reason to start an inspection by checking for compliance. He normally starts by reviewing all available records and reports which may indicate an unsatisfactory trend or situation. He then places his inspection emphasis on those areas of potential deficiencies, particularly those that can develop into trouble areas. The inspector then looks into the extent of compliance as a part of his search for the basic causes of the trouble.

"Inspection for compliance is only a phase of inspection. It is sometimes the starting point but rarely the end point of inspection."

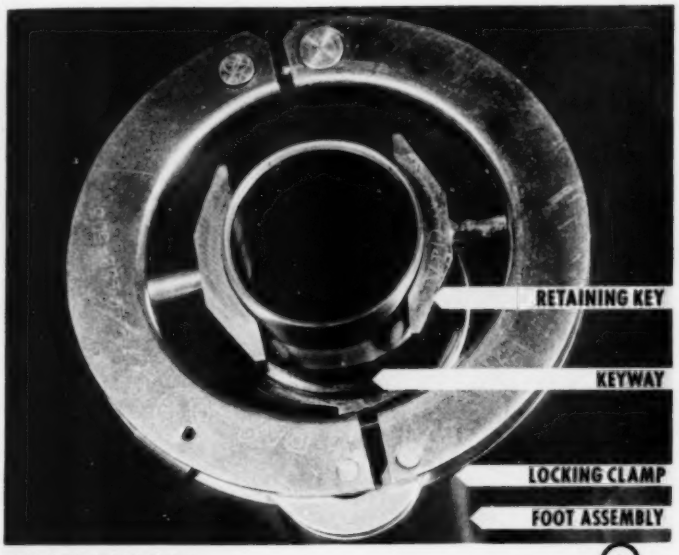
Real Aim of Inspection

"Many suggest that inspection is merely a series of deterrents to wrong-doing. Such a view is far from the truth. The most important duty of inspection is helping to get things right. In so doing, of course, it is inevitable that things which are not right are detected, but the elimination of sources of error, not the rejection of incorrect work, is the real aim. It follows that inspection must favor acceptance of whatever can be used without detriment to safety or serviceability. An organization which confines itself to indiscriminate and unintelligent rejection on no better grounds than departure from stated requirements, can make no genuine contribution to the common purpose and, indeed, will do much to frustrate that purpose. The opposite extreme of blind acceptance needs no warning.

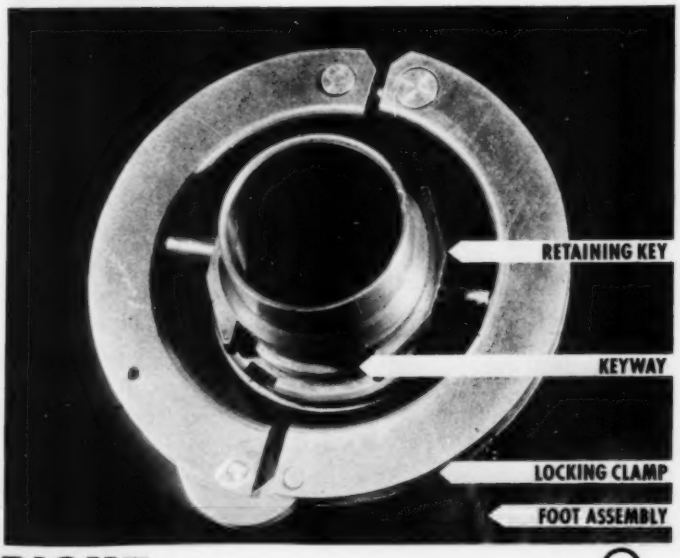
"In short, the proper conception of inspection is 'Safety with Economy' and its procedures are generally designed with this end in view. I think it fair to assume that we all have personally experienced the Inspector who is so cautious that the job becomes bogged down and delay through his inability to assess some borderline manufactured item, except on the rejection principle, or some part of an aircraft that can be safely cleared for further service even though it may not be 100 percent up to the standard prescribed by the Book. Often the old saying of 'When in doubt, chuck it out' is too slavishly adhered to without further examination or second opinion, and economy suffers as a result. It is hardly necessary to state that the other extreme, i.e., the person who will take chances and let anything go, becomes an even worse liability as the standards of safety can be drastically lowered by such an approach."

—Flight Safety Foundation ●

MURPHY'S LAW*



WRONG (1)



RIGHT (2)

*If an aircraft part can be installed incorrectly, someone will install it that way!

The proof of a law or theorem is the consistency with which it is fulfilled. This article was submitted as further proof of the law by VA-196.

A recent instance of improper assembly of a 3A rack resulted in a Mk 1 Mod O BOAR being inadvertently released onto its carriage when the ejector foot was wound down into contact with the store. Disassembly and inspection revealed that the piston retaining keys had been improperly positioned above the upper shoulder of the piston keyway. Photo 1 illustrates the correct positioning of the keys in the keyway. Photo 2 shows the piston locking keys improperly installed above the keyway. Testing the rack in the improperly assembled configuration demonstrated that the ejector foot would not come to a positive stop when it contacted the store. Continued winding caused the release sleeve to raise, moving the pull rods up and releasing the rack.

This incident served to reemphasize the importance of competent supervision and effective quality control measures. As an additional measure to preclude recurrence of a similar error, the reporting command is now visually inspecting racks before each load to insure that locking keys are properly installed. Further, it strongly recommended that a note of caution be placed in the Handbook of Overhaul Instructions, NavAer 11-5E-207, page 10 and the Handbook of Maintenance Instructions, AN 01-40ALF-2, page 377 regarding the placing of the keys.

As the squadron CO concludes, the only way to preclude recurrence of this "Murphy"—as in the great majority of others—is by competent supervision and rigid inspection. ●

CLIPBOARD

Stay Away

Information received from air rescue units presents evidence that civilian pilots are interfering and, in some cases, jeopardizing aircraft engaged in rescue operations. Most of the instances are caused by pilots on sightseeing flights in the immediate area of an accident. Accordingly, the FAA Office of Flight Operations and Airworthiness strongly urges that pilots who are not engaged in the search and rescue operation refrain from conducting sightseeing flights at the scene of an accident while the rescue operations are being conducted.
—*FAA Flight Information Manual*

Collision Prevention Checklist

A PILOT has offered the following checklist as an aid to the prevention of midair collisions:

► Fly at appropriate altitudes for direction of flight VFR (including below 3000' above the surface . . . most of the traffic is at these low altitudes).

► Review cockpit checklist procedures to make sure both pilots are not checking items simultaneously with their heads inside the cockpit. When flying in VFR conditions, at least one pilot should be looking out at all times.

► If you smoke in the cockpit, light your own cigaret. One man can't light another's smoke and look out the window at the same time.

► Straight-ahead climbs and descents in VFR conditions are hazardous. By changing the heading only a few degrees every few minutes, much of the hazard is reduced.

► On test and training flights near heavy traffic areas, maintain a listening watch on the appropriate radar frequency and ask that you be given traffic information. It's easy to become distracted by cockpit duties during these flights, and air traffic personnel usually are not too busy to give you the word, inasmuch as IFR traffic probably is light when the weather is good enough to operate test and training flights.

► Make certain your windscreens are always clean, both inside and out.

► When coming down from altitude, use your defrosters in time.

► Don't just look out, get into the habit of scanning.

► When entering a controlled area VFR, always ask how many aircraft are under control. Then start counting and see if you can get them all in sight.

► If you are, or think you are, on a collision course, don't surmise the other guy will take action. Always act on the assumption he is dumb, blind . . . or fast asleep!
—*Flight Safety Foundation*

Touchdown Impacts

WHEN it feels like you've dropped it in that last foot, maybe you have!

100 FPM is equivalent to ½ inch drop
200 FPM is equivalent to 2 inch drop
300 FPM is equivalent to 4½ inch drop
400 FPM is equivalent to 8 inch drop
500 FPM is equivalent to 12½ inch drop
600 FPM is equivalent to 18½ inch drop

At its design landing weight, a transport aircraft must accommodate a 600 FPM descent velocity (18⁷⁄₁₀ inches free drop) and still maintain acceptable safety margins. If you want more details, refer to Part 4b of the Civil Air Regulations.—*TWA "Flite Facts"*

Improper Reversing Murders Engines

"REVERSIBLE propellers are now practically standard equipment on all piston powered aircraft and have proven to be an invaluable aid for slowing down the aircraft on the landing roll.

"Used as it should be, propeller reversing presents no particular engine problems. However, reversing the propellers to back up an airplane, reversing during slow taxi, or reversing the inboards during taxi to apply excess power on the outboards for ground refrigeration have produced serious engine and accessory problems. There is even an instance reported of reversing alternate pairs of engines to allow a lengthy run-up on an icy taxiway. This is carrying ingenuity too far!

"These abuses of reverse power have been directly tied into exhaust valve and PRT failures, overheated cylinders and damaged ignition wiring due to lack of cooling air flow, and generator drive shaft failures due to overheated front bearings caused by lack of cooling air flow through the blast tubes."
—*TWA Flite Facts* ●

It's Up to You Now . . .

On your way . . . the training, the briefing, the flight planning are behind you. Ahead is the Flight Deck, and your own airborne command. That's one of the things about aviation . . . carrier aviation especially.

No matter what you've been taught, what you've learned, what you've been briefed to do, your actions in the air are subject only to the *words* of others. Everything that you've learned is yours to apply or to ignore, and the only action anyone can take upon you is after the fact . . . the man can chew you out royally for poor air discipline, but he can't reach into the cockpit to make you turn right if you decide to turn left.

Not many lads your age have such an opportunity these days . . . most everyone with his feet on the ground is subject to some form of physical restraint in addition to self-discipline and the discipline of authority.

Your self-discipline in the air is not your own personal affair . . . it belongs to your Navy, your nation. You're expected to use it and to use it as wisely as your innate and achieved intelligence will permit.

It's up to you now . . . you're on your own.

▶ . . . the Black Hole Problem p. 20

▶ "And Then There Was One." p. 4

▶ Visual Glide Path Indicators p. 24